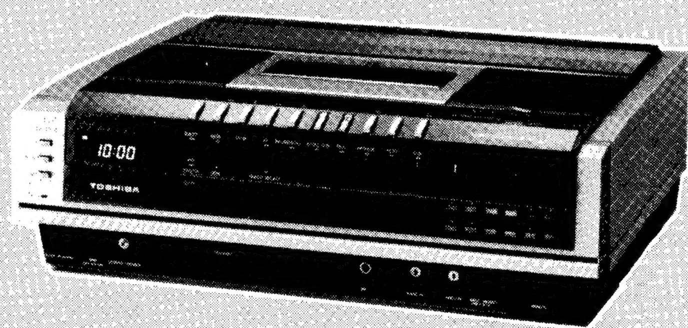
SERVICE DATA
FILE NO. 030-035

TOSHIBA
COLOUR VIDEO CASSETTE RECORDER
V-8600/V-8700

CAUTION

*V-8600 consists of VTR V-8650 and wired Remote control unit (VC-86).
*V-8700 consists of VTR V-8650 and wireless Remote control unit (VC-87)



SPECIFICATIONS

General	
Video recording system	Rotary four-head helical scanning
Head configuration	4-head rotary (HEAD: A, B, B_1, B_2) B_1, B_2; For super SLOW/STILL picture.
Video signal	CCIR standards, PAL colour
Storage temperature	$-20^\circ C$ to $+60^\circ C$ ($-4^\circ F$ to $+140^\circ F$)
Operating temperature	$5^\circ C$ to $40^\circ C$ ($41^\circ F$ to $104^\circ F$)
Antenna	75 ohms external antenna terminal
Channel coverage	UHF E21-68, VHF E2-E12 (a total of up to 12 preselected channels)
UHF output signal	UHF channels E31 to E39 (variable) 75 ohms unbalanced
Power requirements	220V AC, 50Hz
Power consumption	MAX. 60W, AV. 53W
Weight	14.5 kg (32.1 lbs.)
Dimensions	465 (W) x 158 (H) x 385 (D) mm
Video	
Input	VIDEO LINE IN: Phono-type connector $1.0V\ (p\text{-}p)^{+1.0V\ (p\text{-}p)}_{-0.5V\ (p\text{-}p)}$ 75-ohms unbalanced, sync. negative
Output	VIDEO LINE OUT: Phono-type connector 1.0V (p-p) ± 0.1V (p-p) 75-ohms, unbalanced, sync. negative
Signal to noise ratio	Better than 44dB

Audio	
Input	AUDIO LINE IN: phono-type connector, 68k-ohms, −10dB MIC: mini-jack, −70dB suitable for microphone with more than 680-ohms impedance
Output	AUDIO LINE OUT: phono-type connector, less than 10k-ohms, −5dB, unbalanced (load: more than 50k-ohms)
Frequency response	50Hz to 8,000Hz
Signal to noise ratio	Better than 40dB (βNR 52dB)
Audio distortion	Less than 4% at 400Hz
Tape transport	
Tape speed	18.73mm/sec.
Maximum recording time	2 hours 10min. (with L-500 cassette) 3 hours 15min. (with L-750)
Fast forward time	Within 3.5min. (L-500)
Rewind time	Within 3.5min. (L-500)
TIMER	Fluorescent digital display Count down from AC Line frequency

Design and spedifications are subject to change without notice.

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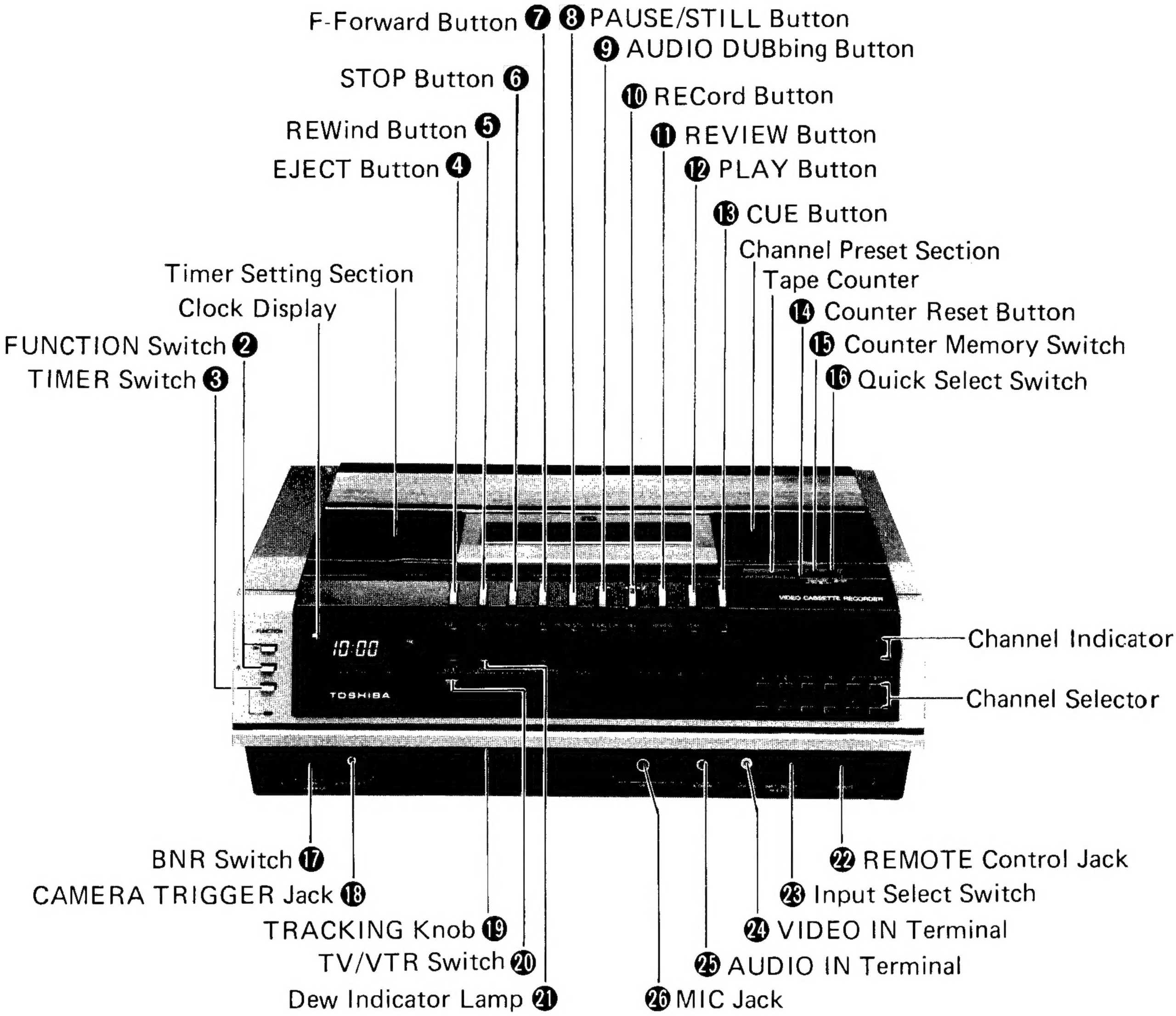
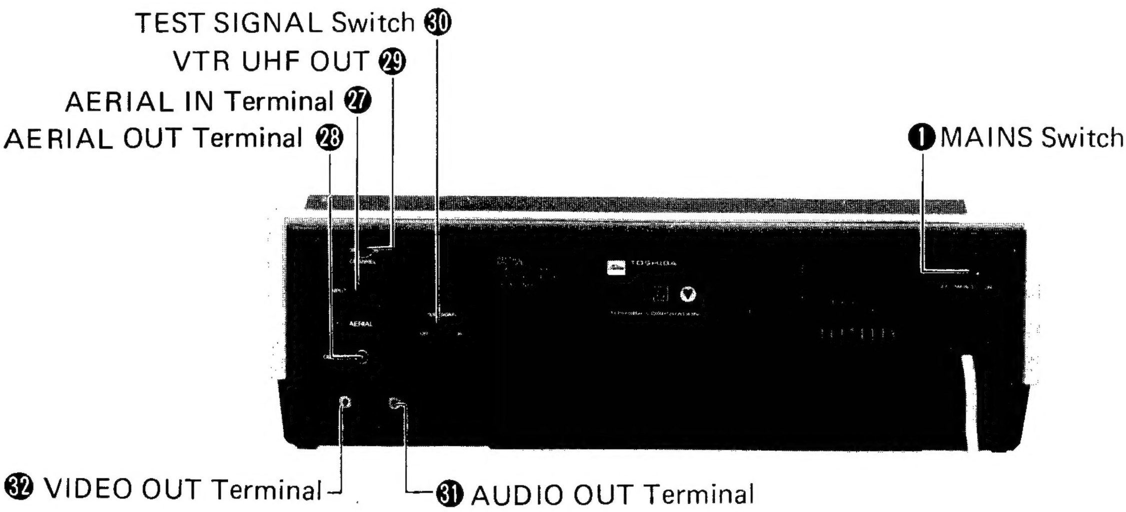
SECTION 1 GENERAL





DESCRIPTION OF CONTROLS

Please refer to the illustrations for the positions of the controls.

❶ MAINS Switch
The mains power switch is located at the rear of the recorder. Switching this ON will supply power to the recorder and the clock.

❷ FUNCTION Switch
With this switch in the ON position the recorder is ready for use and the lamp above the switch will light. The STAND-BY position is used to switch off all functions of the recorder except for the clock, dew heater, and the interface circuit between the recorder and your television receiver. (Without cassette, the cassette compartment rises automatically in ON mode.)

❸ TIMER Switch
The TIMER position is used when you wish to preset the recorder to record future programmes automatically and the lamp below the switch will light.

❹ EJECT Button
Used to open the cassette compartment. The MAINS switch must be in the ON position and the POWER switch must be in the ON position.

❺ REWind Button
Used to rewind the tape.

❻ STOP Button
This button stops the tape under all conditions.

❼ F-Forward Button
Used to Fast-Forward wind the tape.

❽ PAUSE/STILL Button
In the recording mode, you can stop the operation of the recorder temporarily. In the playback mode, you can obtain a STILL picture. (This switch is released automatically after 6.5 minutes.)

❾ AUDIO DUBbing Button
Allows you to record your own sound onto a previously-recorded cassette using either a microphone or audio system. The previously-recorded sound will be automatically erased during this process.

❿ RECord Button
Press this button to record. If the safety tab has been removed from the cassette, it will not be possible to record, thereby preventing your recordings being accidentally erased.

⓫ REVIEW Button
When this button is pressed, the picture moves quickly in reverse (about 7 times the normal speed) and you can search for the desired part of the programme. The speed will accelerate (to approximately 25 times the normal speed) if the button is kept pressed.

⓬ PLAY Button
Press for playing back pre-recorded tape.

⓭ CUE Button
When this button is pressed, the picture moves quickly forward (about 7 times the normal speed) and you can search for the desired part of the programme. The speed will accelerate (to approximately 25 times the normal speed) when the button is kept pressed.

⓮ Counter Reset Button
Used to set the tape counter to the "0000" position.

⓯ Counter Memory Switch
If the counter is set to zero at any point along the tape and the COUNTER MEMORY switch is ON, the recorder will stop automatically at position "9999" during a subsequent rewinding operation, providing an accurate means of locating a particular part of a recording.

⓰ Quick Select Switch
If this switch is ON during recording, the start of each recorded programme is identified so that during subsequent rewind or fast-forward operations the tape automatically stops at the beginning of each recording.

⑰ **BNR Switch**
BNR stands for Beta Noise Reduction. BNR is a noise reduction system which cuts down the tape noise that enters your recordings at the time they are recorded. A tape that was recorded with the BNR switch ON must also be played back with the BNR switch ON. Likewise, a tape recorded in the NORMAL mode should be played back with the BNR switch OFF.

⑱ **CAMERA TRIGGER Jack**
You can start and stop recording by a trigger switch on the camera when you connect the trigger output of the camera to this CAMERA TRIGGER jack.

⑲ **TRACKING Knob**
Used when playing cassettes recorded on other machines using the Beta system. Adjust this control to minimize 'noise' on the horizontal picture lines during playback. Set the control in its centre position when recording and during subsequent playback of cassettes recorded on this machine.

⑳ **TV/VTR Switch**
In the VTR mode, a played back signal from your cassette enters your TV set through a built-in RF unit. In the TV mode, a TV broadcast programme can be viewed at your channel selection. When the PLAY button is pressed, the switch is automatically set to VTR. (The lamp will light.)

㉑ **Dew Indicator Lamp**
When moisture condenses on the head cylinder, the dew sensor will activate and stop all functions and the Dew Indicator Lamp will light.

㉒ **REMOTE Control Jack**
Used to connect the remote control unit. 7 functions can be controlled from this unit.

㉓ **Input Select Switch**
Used to select either a television programme input or a video camera input.

㉔ **VIDEO IN Terminal**
Used for connecting a video camera or other video equipment.

㉕ **AUDIO IN Terminal**
Used for connecting an audio input from other equipment.

㉖ **MIC Jack**
This jack is used for connecting a microphone for dubbing sound onto a tape, or for use with a video camera.

㉗ **AERIAL IN Terminal**
Connect your television antenna to this terminal.

㉘ **AERIAL OUT Terminal**
Connect this terminal to your television receiver, using the cable provided.

㉙ **VTR UHF OUT**
The output from the recorder to your television receiver can be adjusted to any channel from 31 to 39 by using this screwdriver adjustment, as described under 'Preliminary Adjustments'.

㉚ **TEST SIGNAL Switch**
Provides a test signal to assist you to tune your receiver to the output of the video recorder, as described under 'Preliminary Adjustments'.

㉛ **AUDIO OUT Terminal**
An audio signal is available during both recording and playback for use by other equipment.

㉜ **VIDEO OUT Terminal**
Provides a video signal from the recorder during both recording and playback for use by other equipment.

FEATURES

1. **Clean STILL and clean SLOW**
   Clean, practically visual 'noise' free still pictures and slow speed playback are possible with this facility.

2. **MULTI-PICTURE SEARCH**
   By pressing this button you can visually search the tape at about 7 times normal speed for a particular recording. The speed will accelerate to approximately 25 times the normal speed if the button is kept pressed.

3. **7 FUNCTION REMOTE CONTROL (WIRED/V8600, WIRELESS/V8700·E)**
   1. STOP 2. PLAY 3. REVIEW 4. CUE 5. DOUBLE SPEED 6. PAUSE/STILL 7. SLOW (variable).

4. **Feather Touch Controls**
   Thanks to a microprocessor, the operating buttons can be activated with a light touch of the finger.

5. **AUTO REWIND**
   The tape is automatically rewound when the tape reaches the end in the PLAY, REC, FF and CUE modes.

6. **ELECTRONIC TUNER**
   You can select the channel you wish to record by simply pressing this button.

7. **Three Programmes in a Week**
   You can preset your recorder as much as one week in advance to record up to three different programmes.

8. **SOFT EJECT MECHANISM**
   This mechanism allows the cassette to be ejected smoothly and quietly.

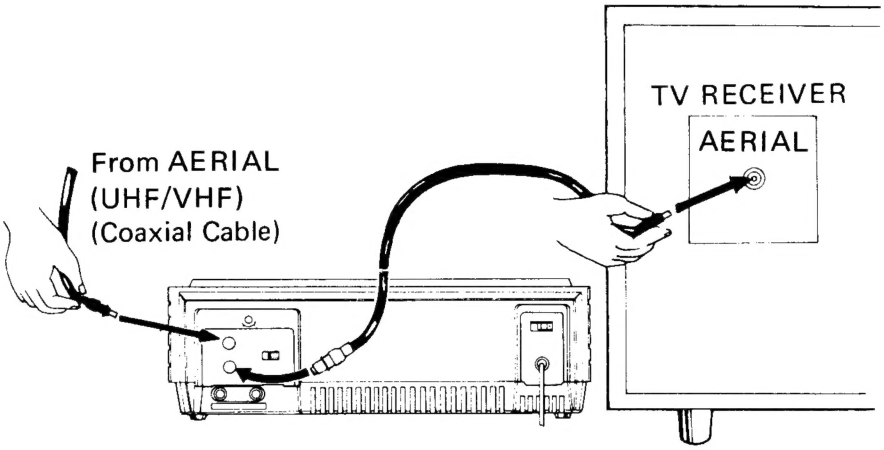
9. **Quick Select**
   Using this facility, the recorder locates the start of a recording automatically without you having to reset the memory counter.

10. **BETA NOISE REDUCTION (BNR)**
    By means of the BNR the signal to noise ratio has been increased to 52 dB.

CONNECTION

UHF TV Antenna Connection.
Remove the antenna lead from the back of your television receiver and plug it into the rear of the recorder at the terminal marked AERIAL IN.

VTR – TV Connection.
Connect one end of the cable supplied to the antenna terminal of your television receiver and the other end to the terminal marked AERIAL OUT at the back of the recorder. Note that the ends of this cable are not the same, so that only one end will fit the television terminal.



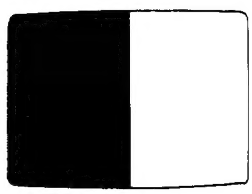
PRELIMINARY ADJUSTMENTS

1. Switch on your television receiver and select a vacant channel button. If your receiver is supplied with a channel button expressly intended for use with a video recorder, then select that button.
2. Switch on the recorder at the mains switch located at the rear.
3. Refer to the section headed 'List of Controls' and check that the controls are set to the following positions:

TV/VTR Switch (20)	set to VTR
FUNCTION Switch (2)	set to ON
INPUT SELECT Switch (23)	set to TV
TEST SIGNAL Switch (30)	set to ON (on rear panel of VTR)

Press the STOP Button (6) to ensure all cassette buttons are released.

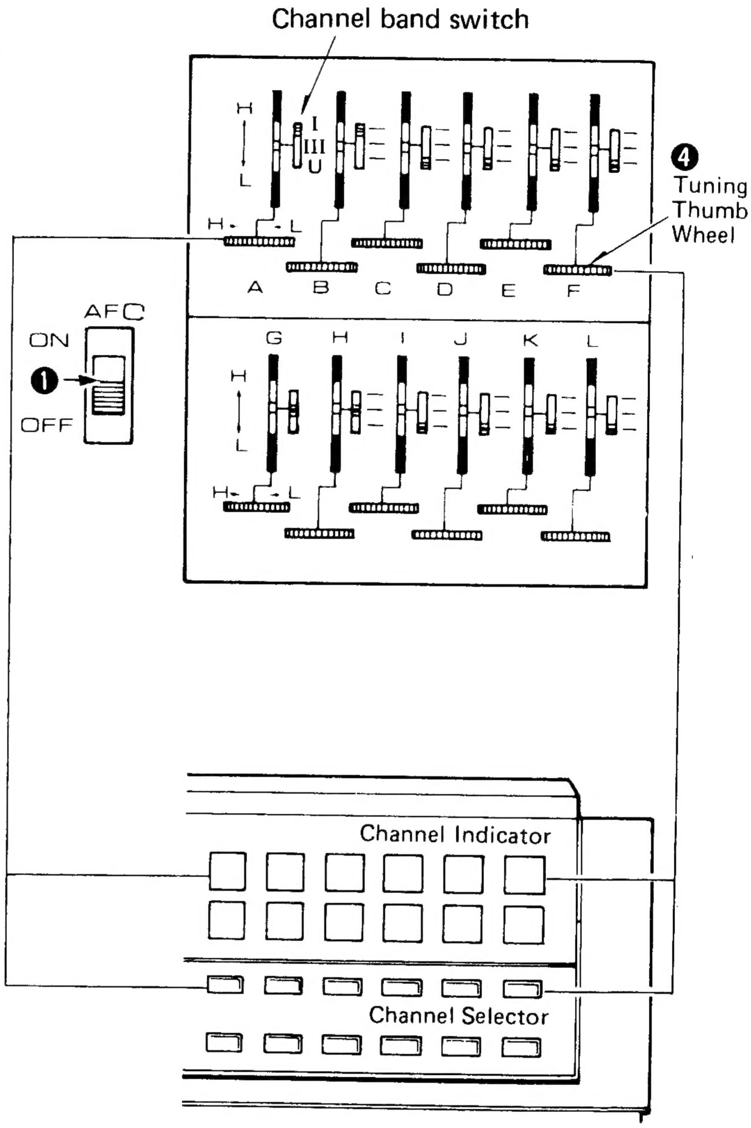
4. Your recorder will now be supplying a test signal to the television receiver and this can be tuned by adjusting the selected channel until the black and white pattern shown below right is clearly displayed.
5. The test signal is on a channel between 31 and 39 and is set during production. However, in rare cases you might experience some interference from an adjacent broadcast channel. This can be overcome by changing the output channel of the recorder, and this is done by turning the small screwdriver-adjusted VTR AERIAL OUTput (29) on the rear panel. Retune your receiver to suit the new output channel.
6. Switch the TEST SIGNAL switch to OFF.



Test Pattern

CHANNNEL SETTING

The Channel Selectors are pre-adjusted at the factory to a range of common channels, but these might not suit your requirements or your local programme channels. However, before changing the channel arrangement, touch each of the selector buttons in turn to see which channels are correctly tuned.

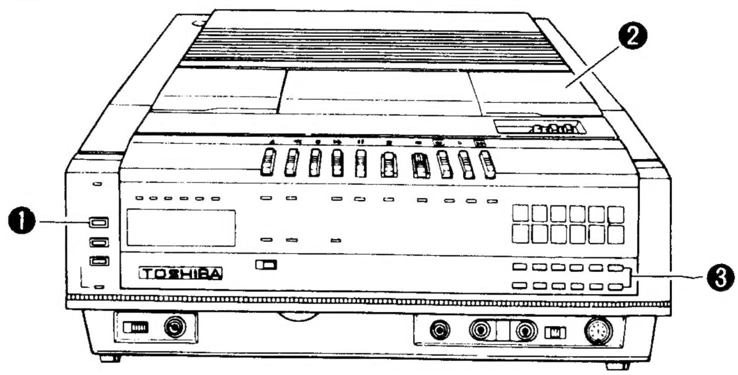


If you wish to change the channel arrangement, proceed as follows:

1. Turn on the Function switch.
2. Open the preset tuning box and set the AFC switch to the OFF position.
3. Touch the channel selector button you wish to tune. The light above the button will show that it has been selected.
4. If you are tuning in channels 2, 3 or 4, set the CHANNEL BAND switch to the I position. If you are tuning in channels 5, 6, 7, 8, ... or 12 set the CHANNEL BAND switch to the III position. If you are tuning in channels 21 through 68, set the CHANNEL BAND switch to the U position.

I : Lower VHF band		(channels 2– 4)
III: Higher VHF band		(channels 5–12)
U :	UHF band	(channels 21–68)

5. Repeat steps 3 to 4 for any other channel selector you wish to use.
6. After you have tuned all the channel selectors, make sure that you set the AFC switch to the ON position.
7. Close the preset tuning box.

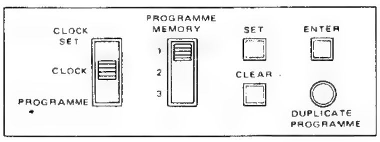


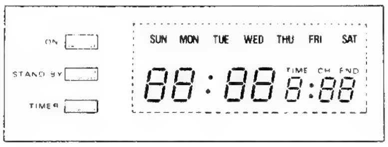
TIMER SECTION

PROGRAMMABLE TIMER

* The clock will continue operating unless the mains power is switched off, but if this is done by accident, as sometimes occurs, the clock control circuits continue to operate for about 10 minutes. This allows you time to switch on the power again without having to reset the clock.
* Using the timer allows you to preset your recorder as much as one week in advance to record up to three different programmes – on different channels.
* Presetting for delayed-action recording of three programmes up to one week in advance is possible, but if a particular day is programmed into the timer, then only programme 3 will continue to be recorded for a second week, whilst the recording of programmes 1 and 2 will be discontinued after the first week. (If no particular day is specified, programmes 1 and 2 will also continue to be recorded for a second week.)
* Whether a particular day is programmed into the timer or not, the recorder can be preset to record various programmes, but the priority will fall on the time setting. In which case, if a mistake is made in the setting of the time and the recording period for one programme overlaps that of another, the DUPLICATE PROG lamp will be displayed. If the error is not corrected, then the recording of the latter programme will be cancelled.
* The clock used is of the 24 hours type.

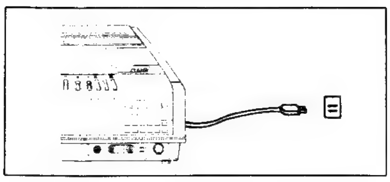
SETTING THE CURRENT TIME



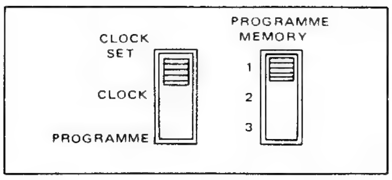


As an example of the setting procedure we will assume it is 13:45 on Tuesday.

1. Connect the recorder to the mains supply and switch on the MAINS switch on.

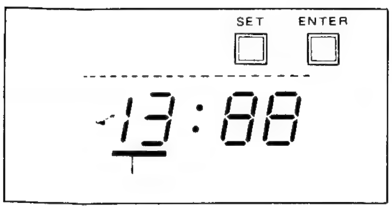


2. Move the CLOCK SET/ CLOCK/PROGRAMME switch to CLOCK SET position.

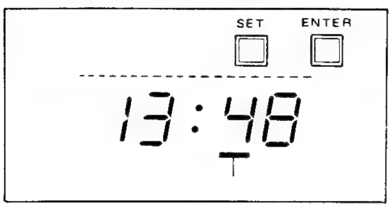


3. First set the day. Press the SET button until Tuesday is displayed. (The indicator will advance one day for each time it is pressed.) Then press the ENTER button and the day will be set.

4. Next set the hour. The hours indicator should be flashing. Press the SET button until the number 13 is indicated. Then press the ENTER button and the hour will be set.



5. To set the minutes requires two separate steps. First, set the ten's of minutes. The ten's of minutes indicator will be flashing. Press the SET button until the number 4 is displayed. Then push the ENTER button.

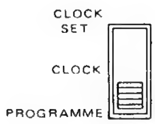


6. Next set the minutes. The minutes indicator should be flashing. Press the SET button until the number 5 is displayed. Then push ENTER. When this is done the END lamp will light. When the time signal indicates the precise time, return the CLOCK SET/CLOCK/PROGRAMME switch to the CLOCK position and the setting of the clock will be completed.

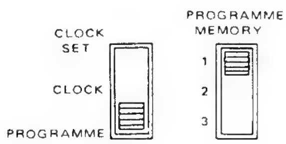
SETTING THE PROGRAMMABLE TIMER

Please note that the maximum time available for recording is determined by the length of tape available in the cassette, so make sure that you use a cassette which is long enough to cover the time required. If you are recording several programmes on one cassette, check that the total programme time does not exceed the length of the tape.

1. Set the CLOCK SET/ CLOCK/PROGRAMME switch to PROGRAMME. (You must set the Function switch to ON.)

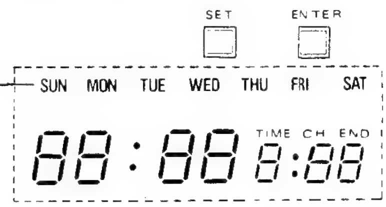


2. Set the PROGRAMME MEMORY switch to the 1 position.

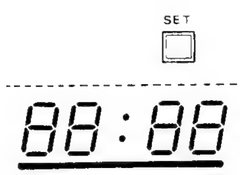


3. Press the SET button to set the DAY. When you wish to programme a certain day into the timer, press the SET button until the desired day is displayed you can use the SET button to advance one day at a push. If you do not wish to specify a day continue to push the SET button until all the days are alight. When you have set the day, press the ENTER button.

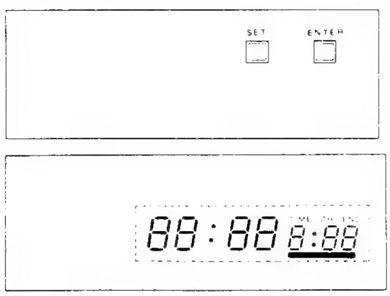
The day indicator lamps will be flashing.



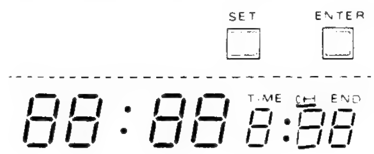
4. Once the day is set the hours will begin to flash set the recording start time in the same way as the clock.



5. Press the SET button to set the duration of recording. (HOUR, MUNUTES X10, MINUTES) and enter this.



6. Press the SET button to set the channel. Indicator will flash and the channel will shift on the channel indicator panel on the right hand side of the set. Press the ENTER button after setting the channel.



7. The END lamp will light to indicate completion of the setting of the programme timer.

If two or three programmes are to be recorded, repeat the above setting procedure at position 2 and 3 of the Programme Memory as required. The recordings will be completed in the order set. Lastly, operate the CLOCK SET/CLOCK/PROGRAMME switch to the CLOCK position.

Example of programme setting

Example (1)
A) Programme 1 – SUN From 8:00 For 30 Mins.
B) Programme 2 – MON From 12:00 For 25 Mins.
C) Programme 3 – TUE From 15:00 For 40 Mins.

In this example only programme 3 will be repeated in the second week.

Example (2)
A) Programme 1 – WED From 17:00 For 20 Mins.
B) Programme 2 – SUN-SAT From 10:00 For 10 Mins.
C) Programme 3 – SUN From 9:00 For 40 Mins.

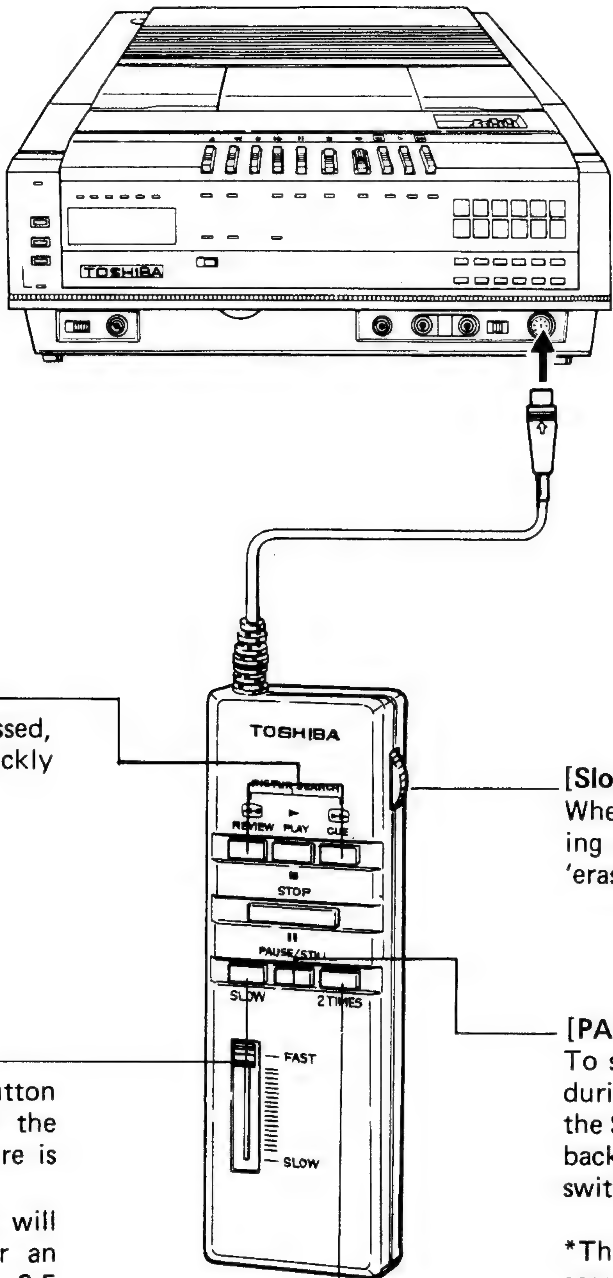
In this second example programme 3 will be repeated in the second week, programme 2 will operate every day for 14 days (If the tape length is sufficient.) Programme 1 will operate only in week one.

Note:
* If only one programme is to be recorded, use position 1 of the PROGRAMME MEMORY switch.
* Three different programmes can be recorded on the same day.
* When setting is complete, operate the CLOCK SET/CLOCK/PROGRAMME switch to CLOCK. The clock will then display the current time.
* If you make a mistake during any of the setting procedures, press the CLEAR button and try again.
* If a particular day is specified, only programme 3 will continue to be recorded for a second week, whilst the recording of programmes 1 and 2 will be automatically discontinued after the first week. But if a particular day is not specified all three programmes will continue to be recorded for a second week.

PGM No.	Day not specified (every day)	Day specified
1	Recording continues for a second week	Recording discontinued after first week
2	Recording continues for a second week	Recording discontinued after first week
3	Recording continues for a second week	Recording continues for a second week

REMOTE OPERATION V-8600

This remote controller is a very convenient accessary. When you watch a pre-recorded tape, you can operate seven functions from your chair.



PICTURE SEARCH
When the button is pressed, the picture moves quickly backwards or forwards.

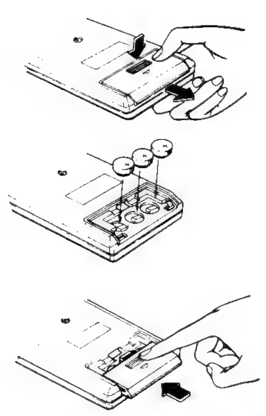
[Slow Playback Tracking Knob]
When visual 'noise' occurs during slow playback it can be 'erased' by adjusting this knob.

[Slow Speed Knob]
By pushing the SLOW button and adjusting this knob the speed at which the picture is moving can be slowed.
*The Slow Speed Mode will cease automatically after an elapse of approximately 6.5 minutes.

[PAUSE/STILL]
To stop the tape momentarily during recording, or to watch the STILL picture during playback, press the PAUSE/STILL switch.

*The PAUSE/STILL mode will cease automatically after an elapse of approximately 6.5 minutes.

[2 Times]
Press for playback at double the normal speed on pre-recorded tape.



Installation the Batteries

This wireless Remote Control is not contained with batteries at delivery from factory. Be sure to put batteries into the transmitter before use.

1. Take off the Battery Cover by pulling.
2. Insert the Batteries (SR44) into the case of transmitter.

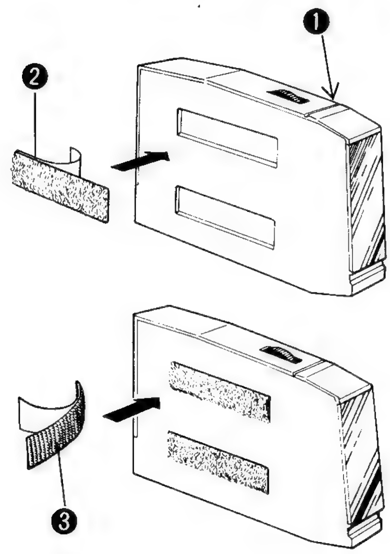
Note: Be carefully to confirm the pole direction. (Plus poles should be upper position.)

3. Close the Battery Cover by pushing.

Note: Do not use any other battery without our designated battery. (Silver Oxide Battery SR44)

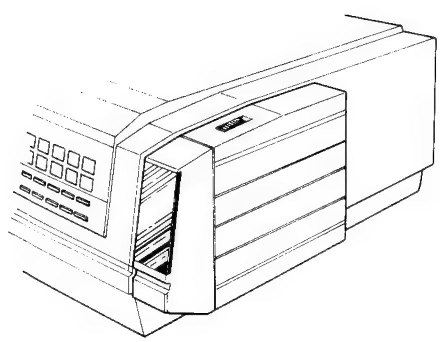
Caution:

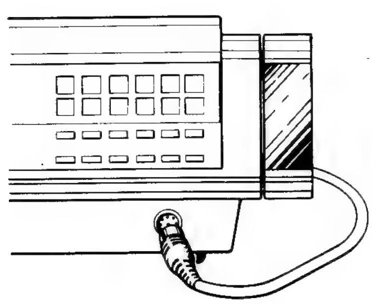
- Remove the batteries from the case of transmitter if the Wireless Remote Control will not be used for any length of time.
- Do not drop or throw the transmitter. This may cause damage.
- Do not install the receiver of the Wireless Remote Control in a location near sunlight. This may cause misoperate.
- Do not wipe with alcohol on receiver. This may cause damage.

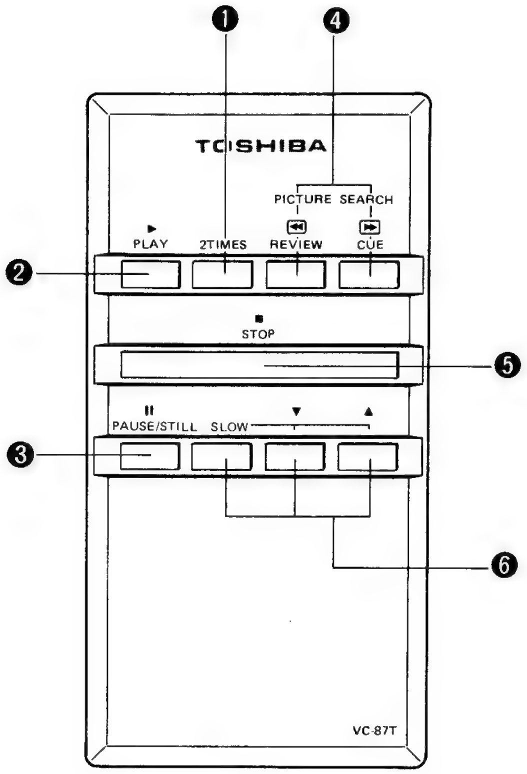


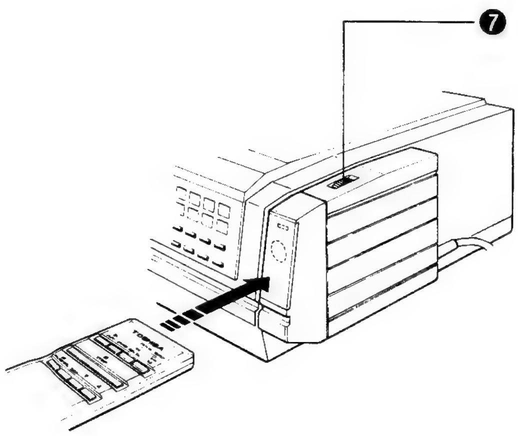
Installation Procedure

1. Take off the protect seal from Loop Fastner ❷ , and attach the adhesive side on the recesses of the Receiver ❶ .
2. Then attach the Fook Fastner ❸ on the Loop Fastner and take off the protect seal from Fook Fastner ❸ .
3. Attach the Receiver ❶ to VTR right side cabinet.
4. Connect the remote cable of the Receiver to the Remote Terminal of the VTR.









<OPERATION>

This remote controller is a very convenient accessary. When you watch a pre-recorded tape, you can operate seven functions from your chair.

❶ [2 Times]
Press for playback 2 times the normal speed pre-recorded tape.

❷ [PLAY]
Press for playing back pre-recorded tape.

❸ [PAUSE/STILL]
To stop the tape momentarily during recording, or to match the STILL picture during playback, press the PAUSE/STILL switch.
* The PAUSE/STILL mode will cease automatically after an elapse of approximately 6.5 minutes.

❹ [PICTURE SEARCH]
When the button is pressed, the picture moves quickly reverse or forward.

❺ [STOP]
This button stops the tape under all conditions.

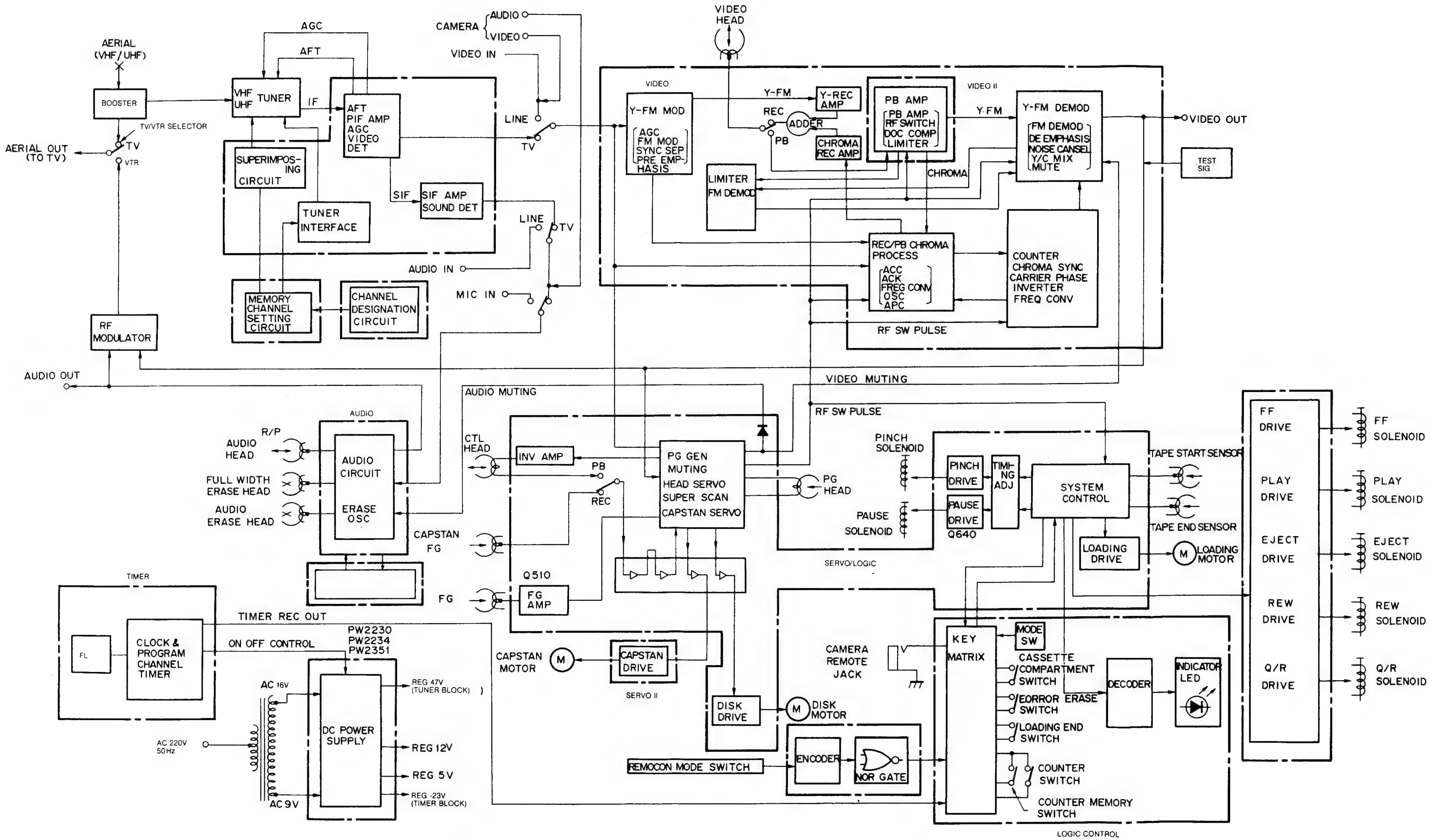
❻ [Slow Speed]
By pushing the SLOW button and adjusting these buttons the speed (1/3~1/30 times normal speed).
The speed can be increased by pressing the right button (▲) and decreased by pressing the left button (▼).

❼ [Slow Playback Tracking Knob]
When visual 'noise' occurs during slow playback it can be 'erased' by adjusting this knob.

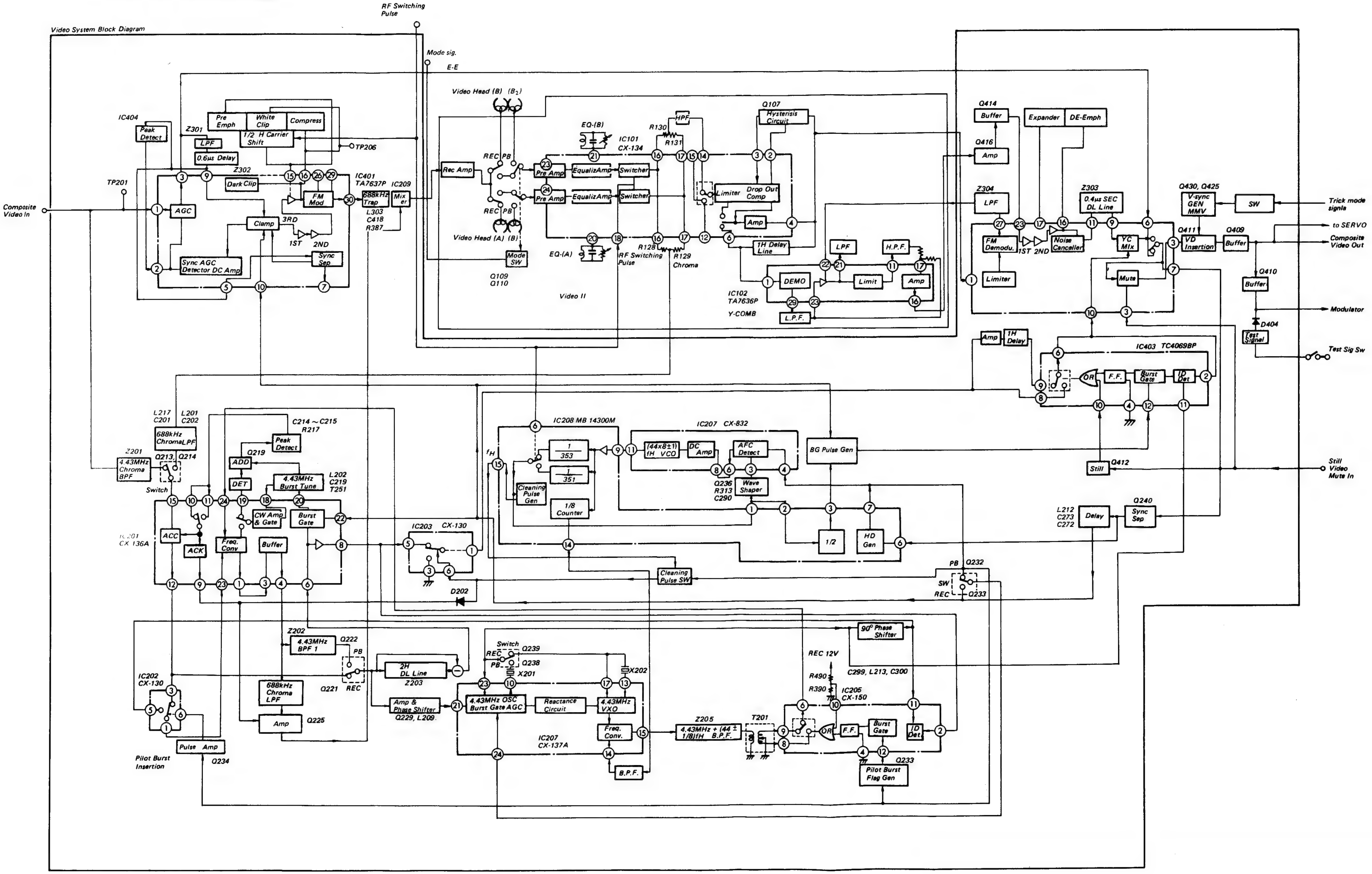
Note: Allowance
Distance: MAX. 7M
Directivity: ±30 degrees

SECTION 2 BLOCK DIAGRAM

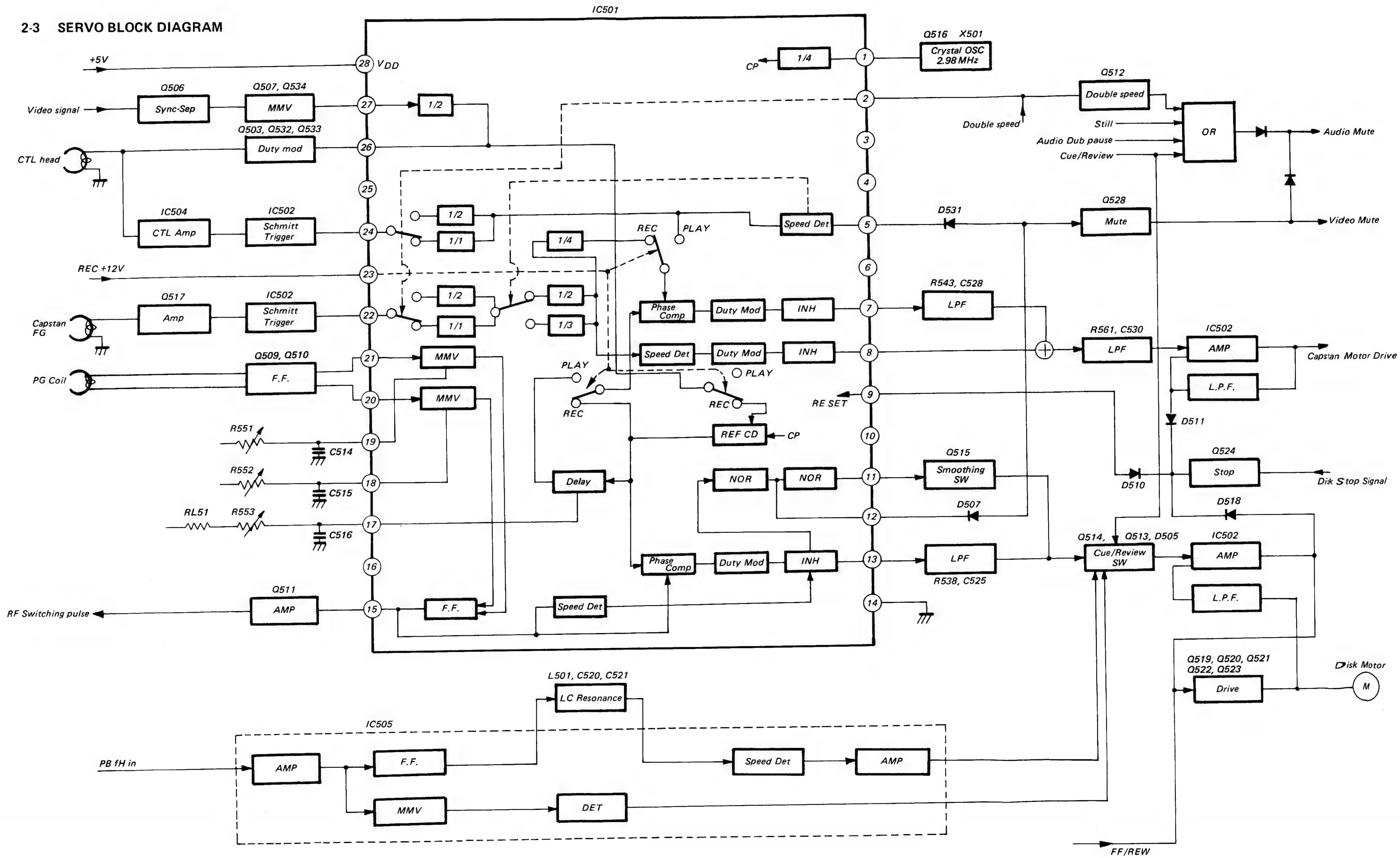
2-1 OVERALL BLOCK DIAGRAM



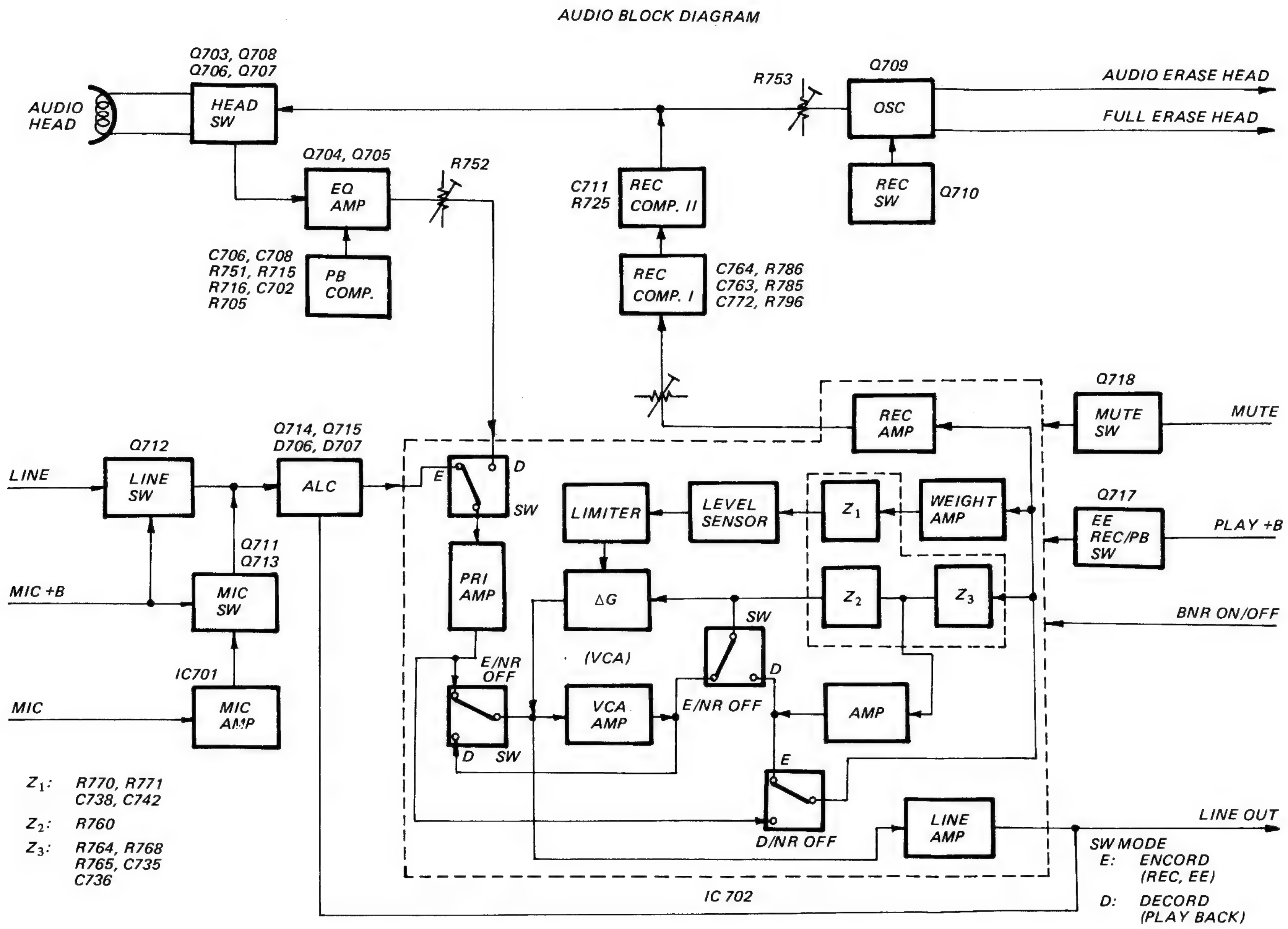
2-2 VIDEO BLOCK DIAGRAM



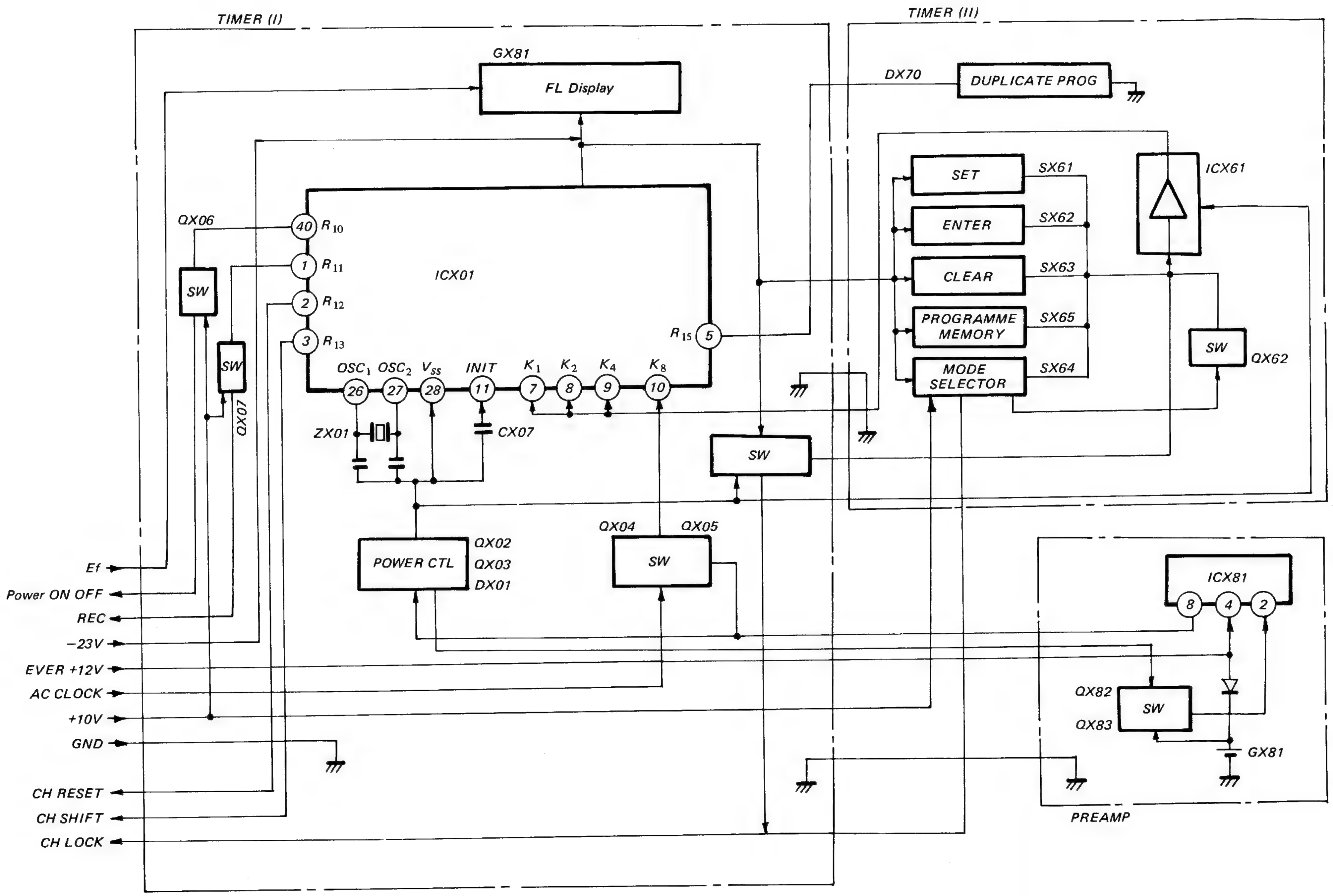
2-3 SERVO BLOCK DIAGRAM



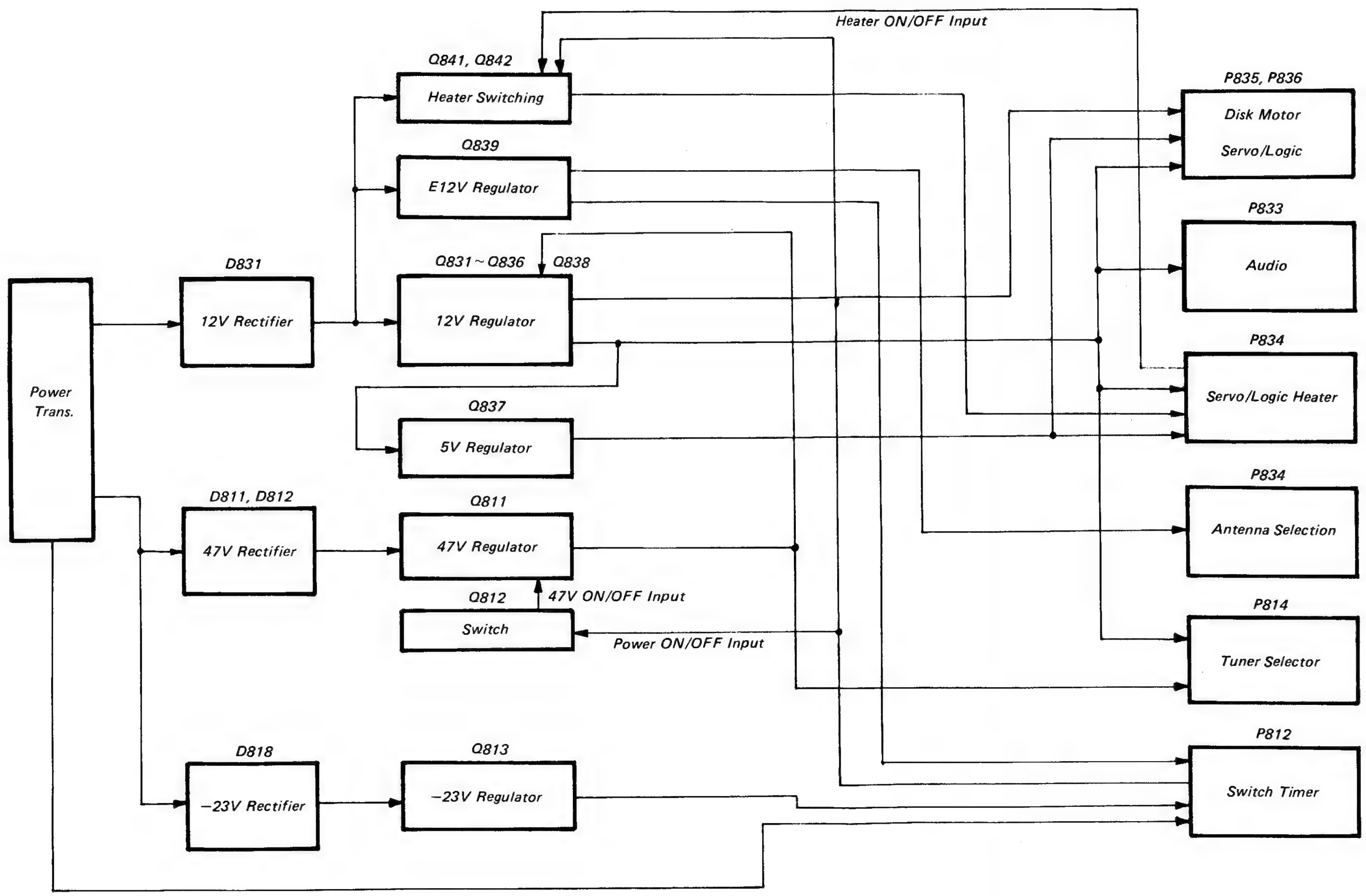
2-4 AUDIO BLOCK DIAGRAM



2-5 TIMER BLOCK DIAGRAM



2-6 POWER BLOCK DIAGRAM



SECTION 3 CIRCUIT DESCRIPTION

3-1 GENERAL

The B-format system is the Y and C separation system. The Y signal is FM-modulated and the chroma signal is frequency-converted to a low frequency range for the AM recording.

The Y Signal is FM-modulated in a frequency deviation between 3.8 MHz to 5.2 MHz in the FM modulator. If the chroma signal is down-converted from 4.43 MHz, a crosstalk interference due to the chroma signal recorded on the adjacent track is caused in the PLAYBACK mode because of the gardbandless recording.

For removing the crosstalk, a frequency difference of 1/4 fH is provided by setting the chroma signal frequency to be recorded on the A track to (44–1/8) fH and the one to be recorded on the B track to (44+1/8) fH and the signals having the 1/4 fH frequency difference are fed to the comb filter where the crosstalk is removed. Since the conversion carrier in the A field is 4.43 MHz+(44–1/8) fH in the PLAYBACK mode as shown in Fig. 3-2, 4.43 MHz is obtained as the chroma signal and 4.43 MHz –1/4 fH is produced as the crosstalk. See Fig. 3-2.

The wave cycle T of the 4.43 MHz chroma signal in one horizontal sync signal is,

$$T = \frac{4.433619 \text{ MHz} - 25 \text{ Hz}}{15.625 \text{ kHz}} = 284-1/4$$

In two horizontal sync signal sections, (284–1/4) x 2 = 568–1/2 waves exist. The 4.43 MHz–1/4 fH = (284–1/4) fH–1/4 fH = (284–1/2) fH which is the crosstalk component has (284–1/2) x 2 = 567 waves in the two horizontal sync signal.

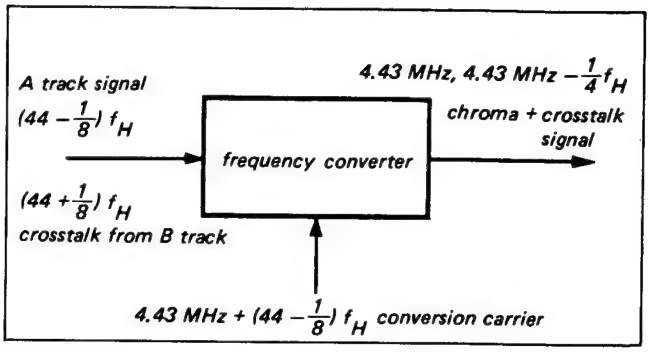


Fig. 3-2 Crosstalk removal in A field

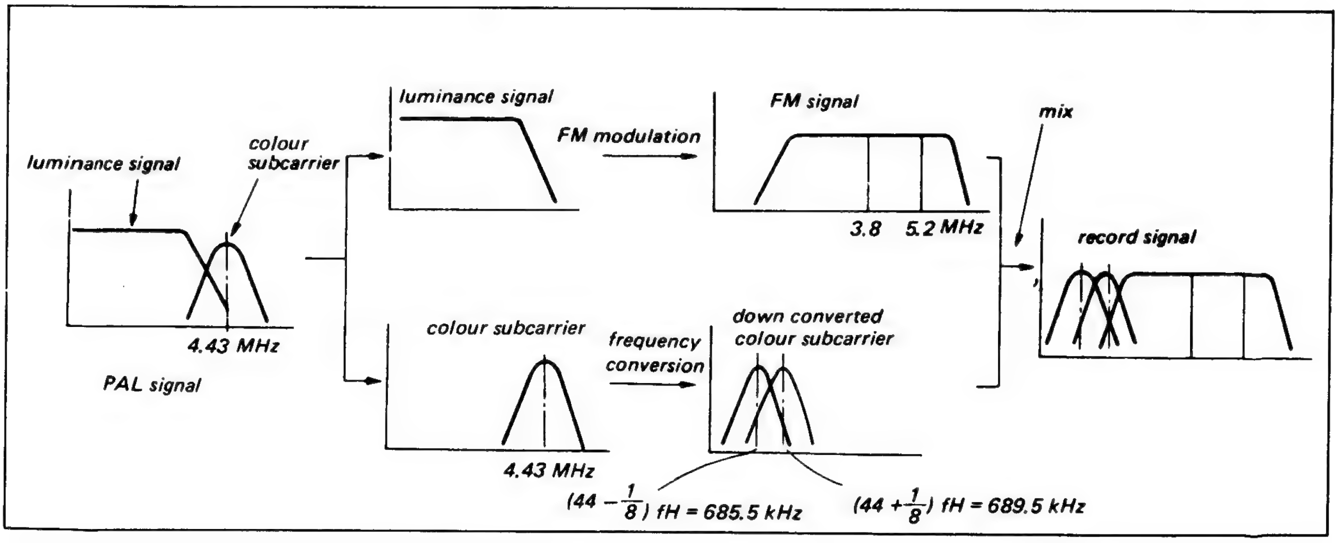


Fig. 3-1 Record signal frequency distribution

Since the 4.43 MHz chroma signal is an opposite phase in the 2H DL output and the 2H DL input and the crosstalk component is a same phase, if a subtraction is performed, only the 4.43 MHz chroma component can be extracted.

In contrast with the A field, 4.43 MHz as the chroma signal and 4.43 MHz+1/4 fH as the crosstalk component are produced in the B field and these are fed through the 2H comb filter in order to extract the 4.43 MHz component.

New APC and AFC systems are adopted for elimination of the phase variation of the chroma signal due to jitter, etc. in the record/playback processes. The conventional system (M system) eliminates the phase variation mainly in the APC circuit. The AFC circuit detects large variation in the tape speed with the playback horizontal sync signal and moves the operation point of the APC circuit, enlarging the APC lock range.

In this machine the low-converted chroma frequency for recording is (44±1/8) fH synchronized with the horizontal sync signal frequency (fH) of the video input signal. As shown in Fig. 3-3, the (44 x 8 ± 1) fH VCO (Voltage Controlled Oscillator) produces a signal (44 x 8 ± 1) times the horizontal sync signal and the produced signal is counted down to 1/8. The sum frequency of the counted-down signal, (44 ± 1/8) fH, and the output of the 4.43 MHz crystal oscillator is used as the frequency conversion carrier for removing the phase variation.

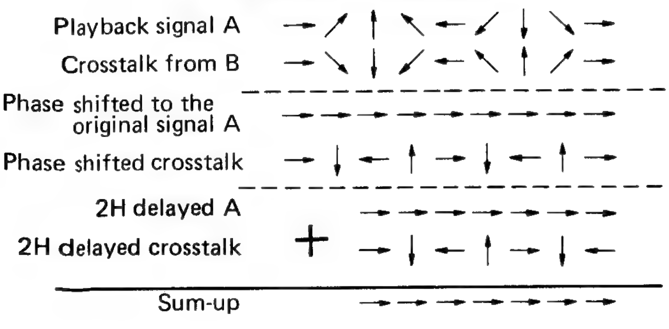
There is a loop which counts down the VCO output to $\frac{1}{352 \pm 1}$ for the phase comparison with the comparison with the horizontal sync signal and controls the VCO with the difference signal obtained from the comparison. This loop is called the AFC.

The chroma and the Y-FM signals are recorded with the above frequency relationship.

The horizontal sync signal phase variation of the playback video signal is equal to approx. $\frac{1}{44 \pm 1/8}$ of the phase variation of the (44 ± 1/8) fH playback down-converted chroma signal. A signal (44 ± 1/8) times the frequency of the playback horizontal sync signal is produced in the AFC loop just as in recording. The frequency conversion, utilizing the sum frequency of the produced signal and the 4.43 MHz output of the crystal controlled oscillator, cancels the phase variation of the chroma signal. (See Fig. 3-5.)

Most of the frequency variation of the chroma signal is eliminated only in the AFC loop and the variation is eliminated in the common APC loop. In the APC loop, the phase of the pilot burst signal of the chroma signal converted to 4.43 MHz is compared with that of the reference 4.43 MHz crystal controlled oscillator and the variable frequency crystal oscillator is controlled by the obtained error voltage. The phase of the variable frequency oscillator output is compared with that of the burst signal of the input chroma signal in the RECORD mode to produce 4.43 MHz as pilot burst signal.

Subtraction of crosstalk



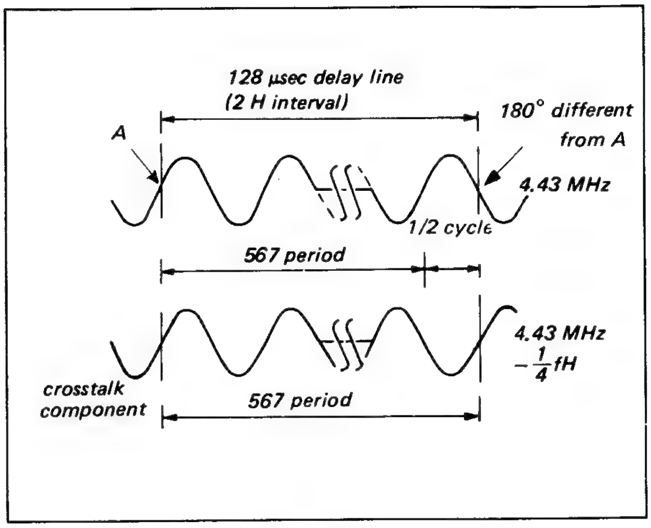


Fig. 3-3

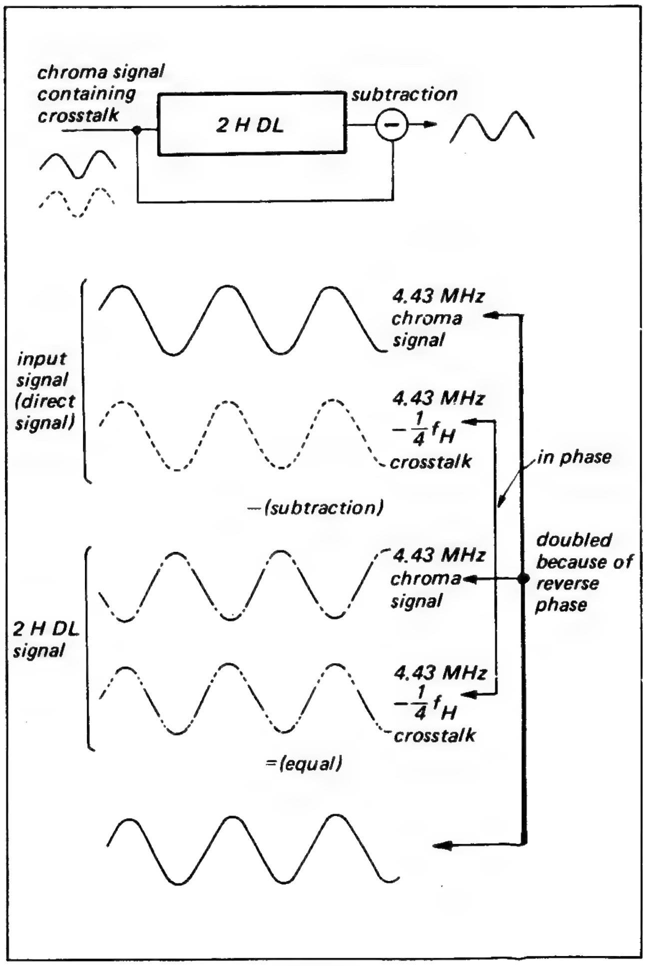
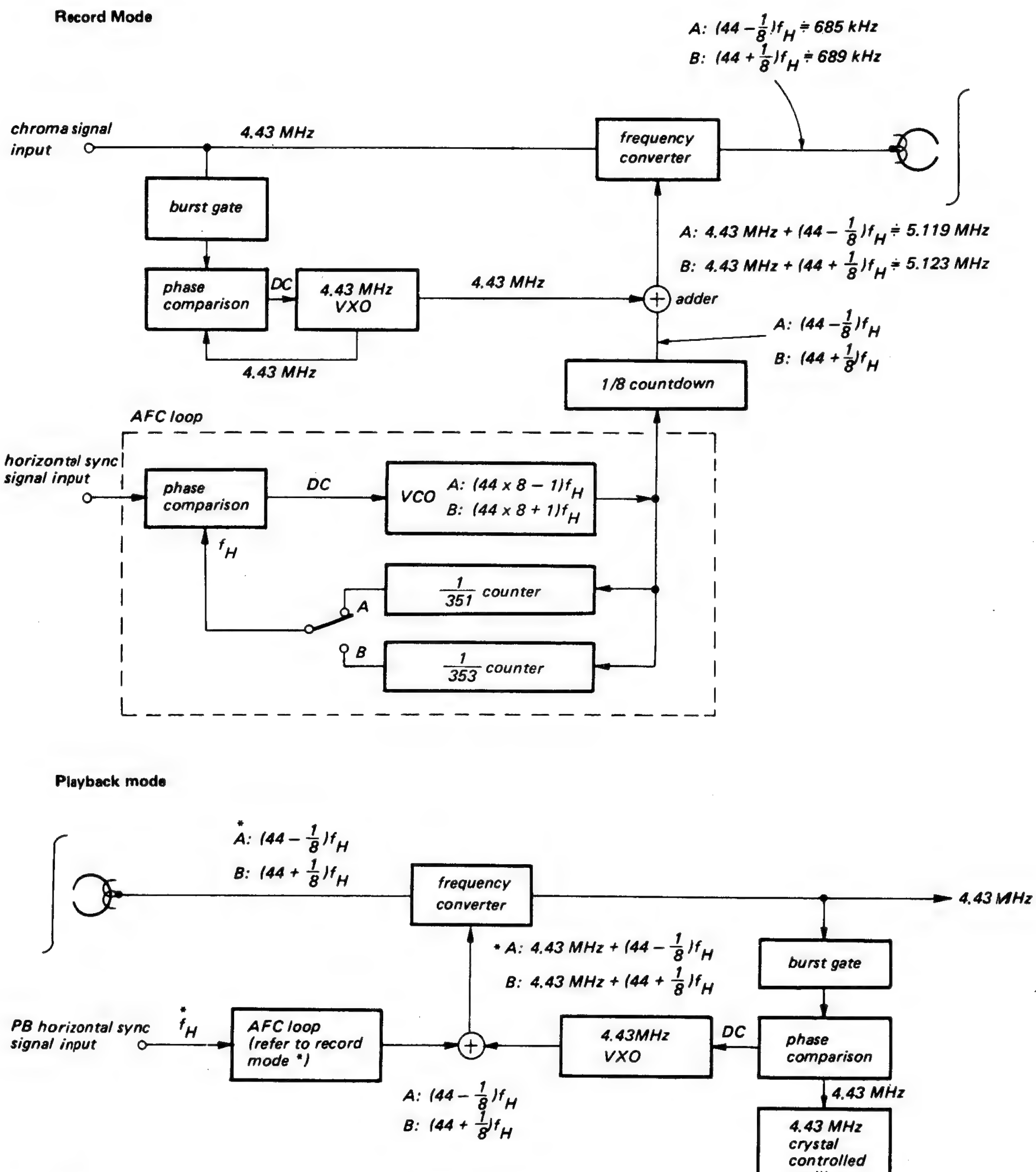


Fig. 3-4



Note:
1. A and B denote the frequencies in the A and B fields respectively.
2. Signal marked with (*) contains phase variation components.

Fig. 3-5 APC, AFC Loop

3-2 VIDEO SYSTEM CIRCUITRY

The video system circuitry consists of the circuits on the VIDEO I and PREAMP boards.
The record/playback processing circuits for the chroma/luminance signals are on the VIDEO board. The video circuitry is highly integrated with ICs as shown in Fig. 3-6.

Luminance Signal Circuit System.
The luminance signal circuit system has four ICs: TA7637P, CX134A, and two TA7636P. TA7637P contains the process circuits of the recording system such as the AGC, clamp, FM modulator and other circuits. CX134A contains the playback pre-amplifier, RF switcher, limiter, and dropout compensator. One of TA7636P contains the FM demodulator, noise canceller, Y/C mixer, and other circuits. The other one is used for Y-comb filter circuit which is newly developed to improve S/N ratio of the PB luminance signal.

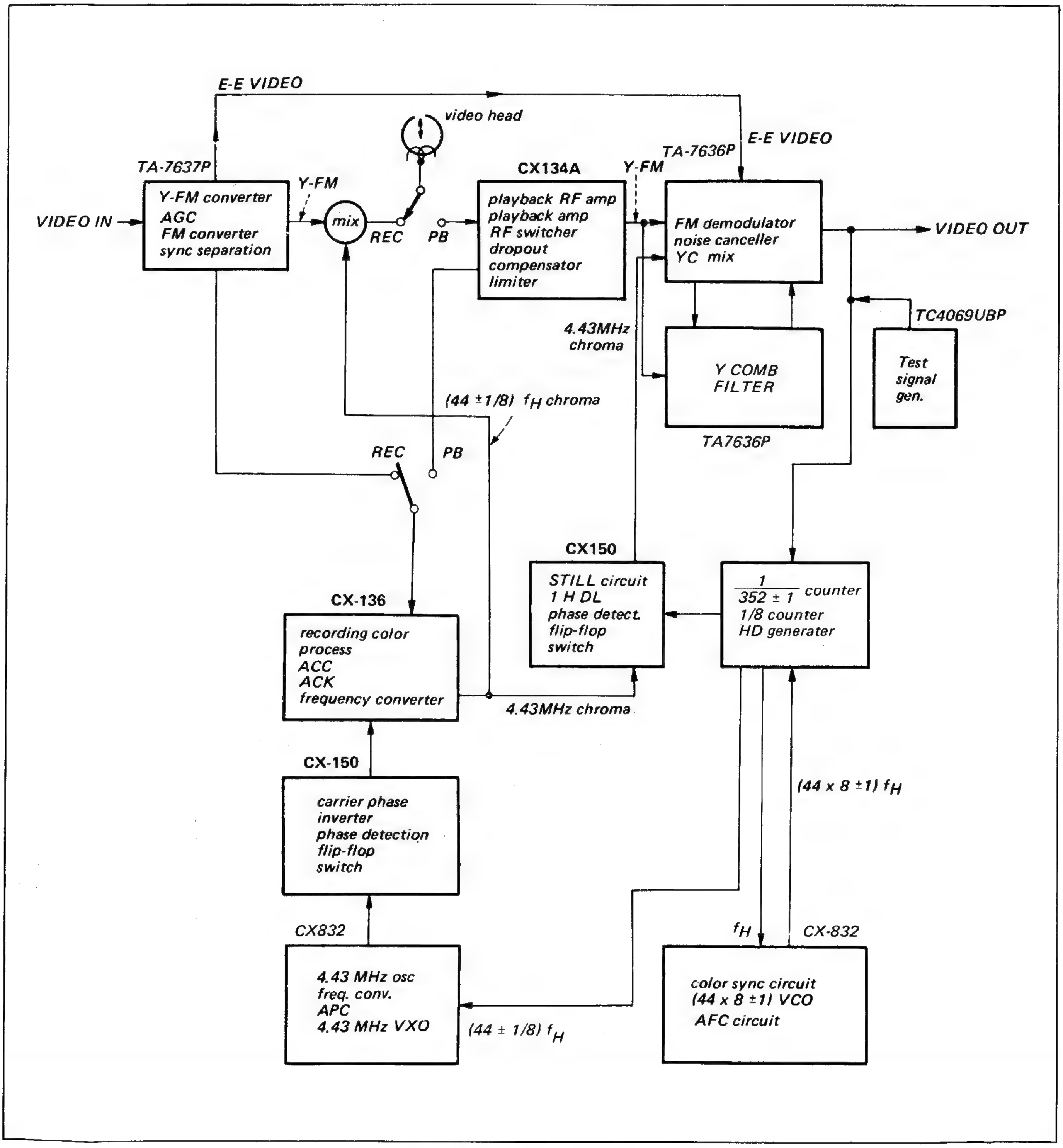


Fig. 3-6 Video Circuit IC Block Diagram

[Video Input]

The RF signal fed to the V-8600/8700 VTR is demodulated to video signal through the Tuner Block. The video signal is connected to pin-1 on P202, and then to the INPUT SELECT switch S201.

The external video from a TV camera enters the VIDEO pin jack P214 and also is connected to the same INPUT SELECT switch S201. Either one of the video signals is selected by the S201 and then is fed to pin 1 of IC401.

AGC Circuit and Y-FM Modulator

IC401 (TA7637P) process the video signal from the AGC to the FM modulator and supplies the Y-FM signal to the PREAMP circuit.

The video signal applied to pin 1 is regulated to a constant amplitude in the AGC, which is a sync level AGC.

The standard ratio of the video signal to the sync signal (V/S ratio) is 0.7Vp-p to 0.3Vp-p. A video siganl level varies depending on the contrast ratio of a picture. A simple peak AGC system functions to keep the composite video signal constant, which causes to vary the amplitude of the sync signal. Therefore the sync level AGC detects the sync amplitude, which is not related to the contrast ratio of a picture and functions to make the amplitude constant. To detect the sync amplitude a pulse is inserted into the back porch of the horizontal blanking of the video signal. (See **Fig. 3-7**)

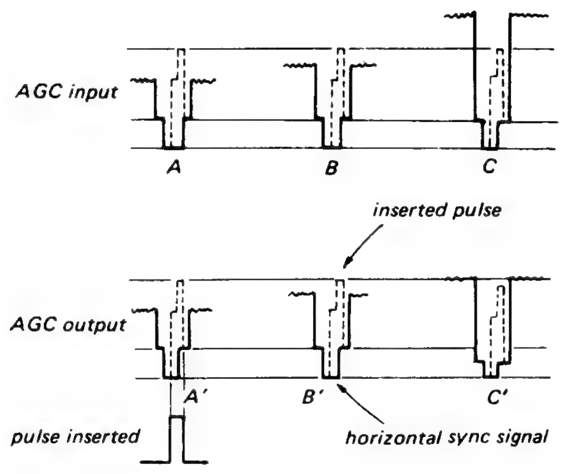


Fig. 3-7 Sync-AGC

The video amplitude is fixed by the pulse amplitude in the detection of the video signal and any variation in the sync amplitude can be detected. But when the video component in the input video signal is more than 105%, which is determined by R451, the peak AGC (IC404) circuit functions so that the composite video signal becomes constant. The pulse inserted for the AGC is obtained by Burst gate pulse.

The AGC circuit is shown in **Fig. 3-8.**

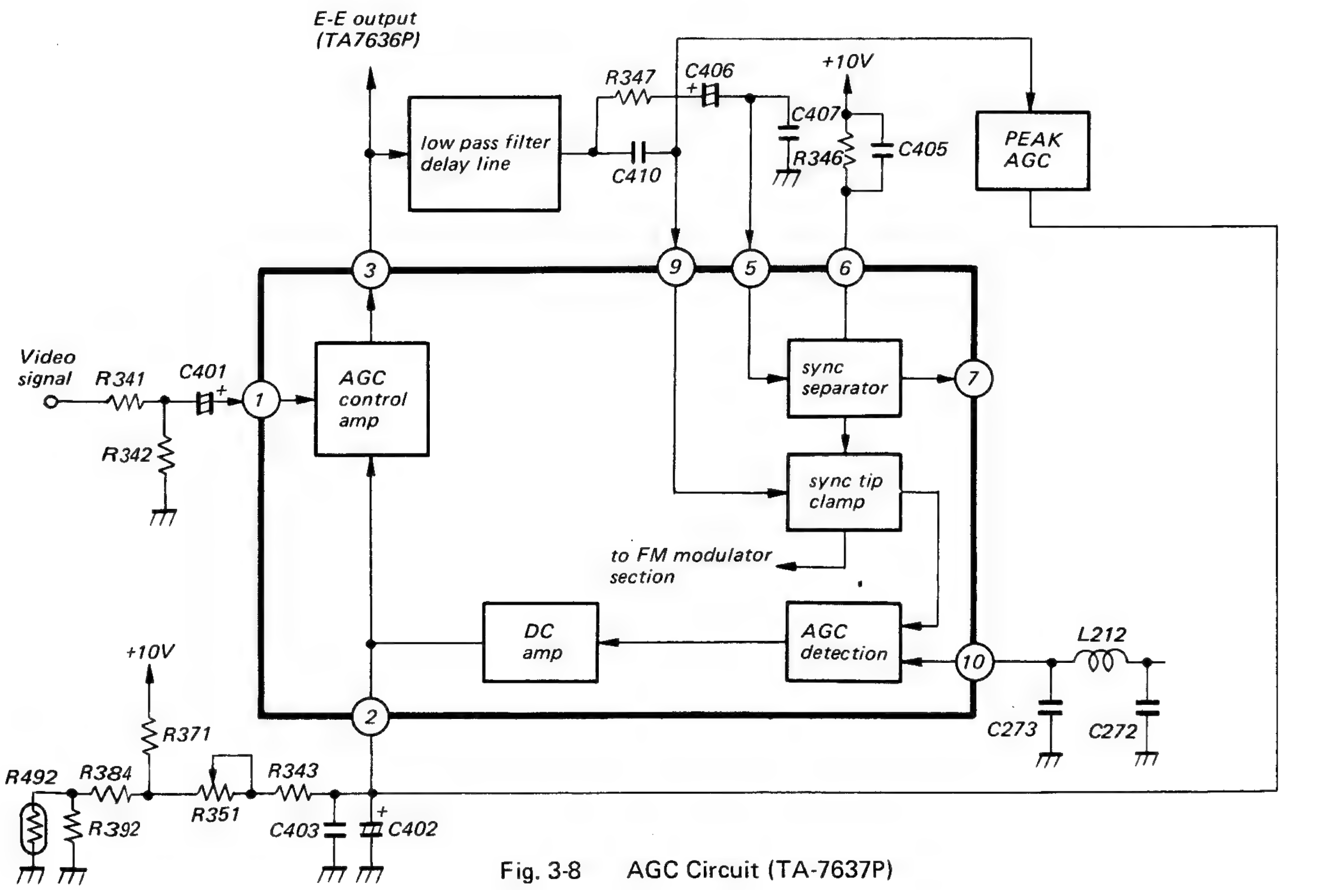


Fig. 3-8 AGC Circuit (TA-7637P)

IC404 contains peak AGC and only amplifies the video signal of which DC level is higher than the reference DC voltage at Pin 3.
That signal is detected by C446 and is supplied to Pin 2 of IC401.
The luminance signal output from pin 3 is supplied to the sync separation section at pin 5, the clamp and AGC detection section at pin 9 through low pass filter (Z301), 0.4µsec delay line (Z302) and buffer Q407.
The sync separator is between pins 5 and 7. It extracts the sync signal which is clamped by feedback and sliced. The R347 and C407 circuit connected to input pin 5 is a low pass filter for rejecting noise.
Sync signals supplied internally to the clamp stage for the sync tip clamp of the video signal. The signal applied to pin 9 is processed for the sync tip clamp with the sync separation output in the clamp stage and supplied to the FM modulator section and the AGC detection section.
The sync signal separated from the luminance signal in Q240 is delayed through C272, C273 and L212 and is fed to pin 10 of IC401, and then, is wave-shaped and is added to the horizontal blanking porch as shown in Fig. 3-9.
The peak level of this pulse is detected through C404 and R344 connected to pin 4 and is detected again through C402 and C403 connected pin 2, then detected potential is fed to the AGC control amplifier. (Fig. 3-8)

The circuit between pins 1 and 3 of IC401 (TA7637P) is the AGC control amplifier. The AGC control is changeability by current flows from power supply circuit to pin 2. The AGC output from pin 3 is supplied to the direct E-E circuit. This E-E output is supplied to the PB/REC output switch circuit of IC402 (TA7636P).
The sync tip clamped video signal goes through the non-linear emphasis circuit and is frequency-modulated. (See Fig. 3-9.)
The non-linear emphasis circuit comprises the compress circuit and the pre-emphasis circuit and is connected to the pins 15 and 16 of IC401. The compress amount is adjusted with R353. The compress operation is performed by utilizing the non-linear characteristic of diodes D413 and D414 which are temperature-compensated by Q424. The white-clipped output is supplied to pin 16 of IC401 and frequency-modulated.
The FM modulator employs an astable multivibrator which oscillates at the frequency determined by C416. The frequency varies in proportion to the level of the video signal applied to the modulator. The oscillating frequency is adjusted by varying the bias current with R354. And the 1/2 fH shift is performed every field with the RF switching pulse. The deviation is adjusted by varying the AGC set current with R351 for varying the video signal amplitude.
The FM modulated output goes through the 685 kHz/689 kHz trap (consisting of C418, L303 and R387) to pin 3 of IC209 mixer.

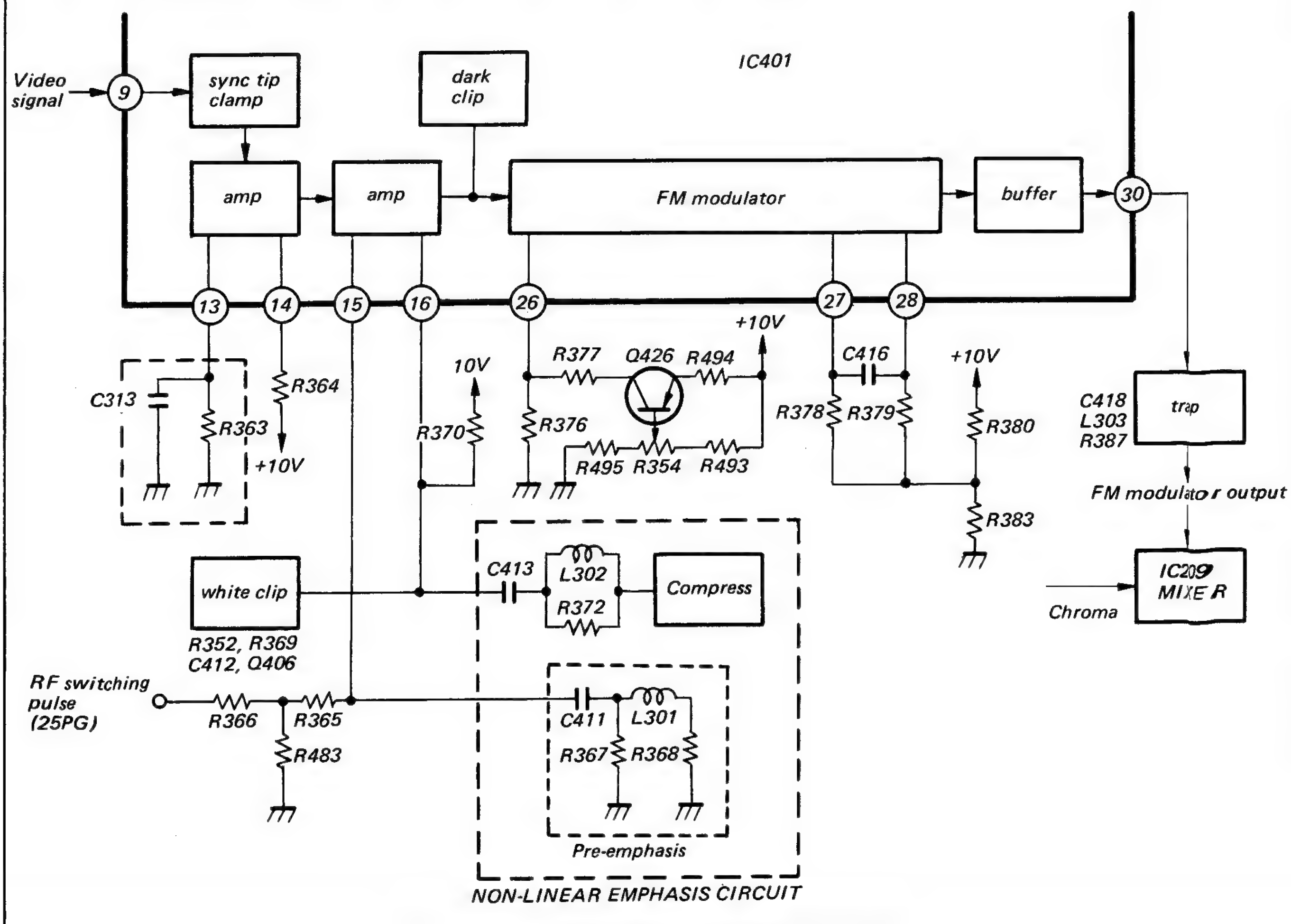


Fig. 3-9 Luminance Non-linear Pre-emphsis and FM Modulator Circuit

[MIXER]

The FM signal supplied to Pin 3 on IC209 is mixed with chroma signal applied to Pin 1, and is fed to PREAMP board.

L312 connected to Pin 2 of IC209 compensates the Play back frequency characteristics.

[VIDEO PREAMP DOC CIRCUIT]

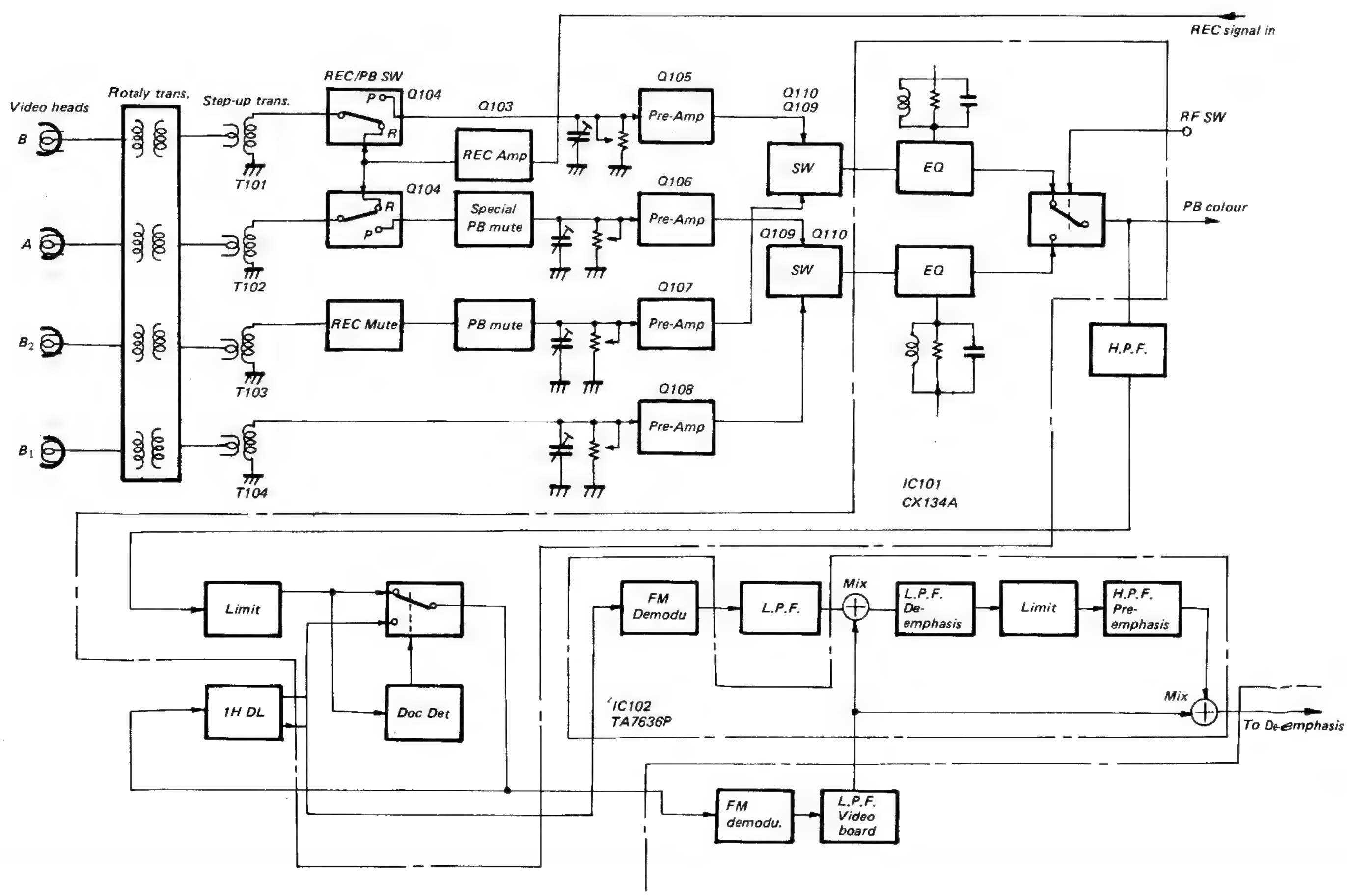
Recording Amp and Record/Playback Head Switch (Q103, Q104)

The output from Pin 4 of mixer IC 209 of video board is supplied to Q103 of video preamp board. Q104 which was on during playback will be off during recording and the recording signal is fed to heads A and B by recording amp Q103. Together with supplying the collector current for Q103 at this time, diodes D101 and D102 connected to one side of the step up transformer fulfills the role of the head switch to lower the AC impedance between the head and ground.

On one hand, as current flows in the special playback heads B'_1 and B'_2 during recording due to crosstalk within the rotary transformer, shorting diode D105 in the channel adjacent to the standard playback side to cancel out the leakage magnetic field from the standard playback side.

Outline of the Preamp Circuit

This preamp incorporates a switching circuit to change over the head during FET amplification in the initial playback stage and during special playback (slow, still Q&R) and the recording amplifier and recording/playback head switch. This unit is of a 4 head construction heads A and B during standard playback and heads B'_1 and B'_2 during special playback (slow, still Q&R) and symbols A and B indicates the azimuth angle. In other words, the azimuth angles of B, B'_1 and B'_2 are equal and A only is facing the opposite direction. On one hand, the combinations corresponding to the same switching pulses are A, B'_1 and B, B'_2. Therefore, if we trigger the circuit with a negative switching pulse while viewing the envelope on a oscilloscope, it will be A during standard playback and B'_1 during special playback. If triggered with a positive switching pulse, it will be B during standard playback B'_2 during special playback.



Pre-amplifier Circuit (Q105, Q106, Q107, Q108)
The small video output signals are fed to the step up transformer (T101, T102, T103 and T104) in the pre-amp board through the rotary transformer. This output is adjusted so it will peak near 5.2 MHz due to the resonance of the head inductance and the trimmer capacitors C151, C153 and C154. After adjusting the amount of peaking with the variable resistors R151, R152, R153 and R154, the signal is fed to the FET amplifier (Q105, Q106, Q107, Q108). These FET's are connected to the IC's in the video board.

Standard Playback and Special Playback Switching Circuit (Q109, Q110)
During standard playback, Q110 goes off and raises the source voltage of the FET (Q107, Q108) on the special playback side and thus stops the signal flow. As current flows in D104 from R153 and shorts out the signal by lowering the impedance of the diode, it serves to reduce crosstalk between circuits and crosstalk between channels within the rotary transformer. During special playback, Q109 is turned off and conversely, the standard side is muted.

[VIDEO PRE-AMP]

Equalizer Circuit IC 101 (CX 134A)
The output of the cascade amplifier in the CX134A passes through the emitter follower and is supplied to the equalizer amplifier. The parallel circuit L.C.R. connected to Pins 20 and 21 of IC101 becomes the collector load to form the equalizer circuit and possesses a resonant point near 6.0 MHz.

(Switching Circuit IC101)
The equalizer amplifier output is supplied to the RF switching circuit. A 25 Hz switching pulse is applied to Pin 18 of IC101. When Pin 18 becomes high, Pin 21 becomes low and signals are obtained from Pin 20. The RF output removed from the overlapping portion of both channels is obtained here. The switching circuit output passes through the amplifier and emitter follower and is obtained from Pins 16 and 17. The outputs from both channels obtained at Pins 16 and 17 are mixed in a resistance mixer circuit and become continuous outputs. The RF signal mixed by means of R128 and R129 is supplied to the color reproduction circuit through the series resonant trap made up of L109 and C127. As the resonant frequency of the trap is 55 KHz, the signal from the erasing oscillator entering the color circuit prevents beat frequencies from being generated during Audio dubbing.
On one hand, the color portion of the signals mixed by R130 and R131 is removed in the L110, C125 trap and, after passing through the high band filter and being converted to Y-FM signal only, is fed into Pin 14.

Limiter Circuit (IC101)
The input from Pin 14 is supplied to the limiter circuit where it carries out amplitude limitation of the Y-FM signal and removes the variable portion of the amplitude of the reproduced signal. This limiter output normally passes through the D.O.C. switch and through an amplifier and is output from Pin 4.
The output from Pin 4 is fed to Pin 1 of the FM demodulation circuit input IC402 and at the same time is also fed to the 1H glass delay line X101. As this 1H glass delay line incorporates a Y comb type 1H delay line, it has a wide usage band.

Drop Out Compensation Circuit (IC101, Q111, X101)
The Y-FM signal fed to the 1H delay line is delayed 1H and is supplied to the D.O.C. switch from Pin 6. The limiter output is detected and drop out here is detected as pulses.
C129 and R140 on Pin 7 form the smoothing circuit for the detector output. The detector output is then formed into switching pulses in the Schmid trigger.
R157 changes the sensitivity of the Schmid trigger and adjusts the degree of drop out compensation. The Schmid trigger output is fed to the D.O.C. switching section in the form of switching signals. The D.O.C. switch is caused to change over in the drop out section and a signal 1H prior is fed into this section. Q111 connected to Pin 2 is caused to go ON and OFF by means of the drop out detector pulses. This causes R134 to short out and open and thus create a hysteresis effect at the D.O.C. operation level. As the image will not be faithfully reproduced if the D.O.C. circuit functions during special playback, the D.O.C. must be forcefully turned off. This is carried out by means of the special playback mode signal which raises the DC voltage on Pin 3 with Q112 and Q113.

Y Comb Type Noise Cancelling Circuit
The Y comb type noise cancelling circuit removes only the vertical beat due to crosstalk and the non-related noise elements by means of its comb type filter using a 1H delay line. This is then fed to the original signal in reverse phase to effectively cancel out crosstalk and noise and thus improve the S/N ratio.
Although a comb type filter may also be formed by delaying the video signal itself by 1H, a 1H delay element with an extremely wide band width will be required in this instance. The comb type circuit permits the usage of a small glass delay line by passing the Y-FM signal in its original state through a 1H delay line and it will also be possible to use this in common for drop out control.
The block diagram of the Y comb type cancelling circuit is shown in Figure 3-10.
As shown in Figure 3-10, the reproduced Y-FM signal is separated into those that are demodulated directly and those that are demodulated after a 1H delay. If the respective demodulated video signals are shown, they would appear as in Figure 3-11A (Direct Demodulated Signals) and 3-11B (1H Delayed Demodulated Signals).
As this is to show a typical example of the sine wave on the video signal being one form of crosstalk, to show the video signal in simple form, emphasis has not been applied.
Theoretically cancellation will be complete if the crosstalk portion shift of 1/2 H is accurate. Random noise is also reduced and S/N ratio is improved to −3dB.
Furthermore, in relation to sharp variations of the picture in the vertical direction or, in relation to non-interrelated 1H symbols before and after the vertical synchronous signal, the signal obtained by subtracting mixture 1 will contain extremely large pulse elements compared to the crosstalk noise elements. If this signal is subtracted from the original direct demodulated signal, it will result in a decrease in vertical resolution and irregularities in the vertical synchronizing signal. To prevent troubles of this nature from arising, a limiter is used on the large pulse elements and the signal is first passed through an LPF (practical deemphasis circuit) as the crosstalk portion (noise portion) will be subjected to limitation if left in state of emphasis.

When subtracting from the original signal, it is first carried out after passing it through the HPF (practical pre-emphasis circuit).

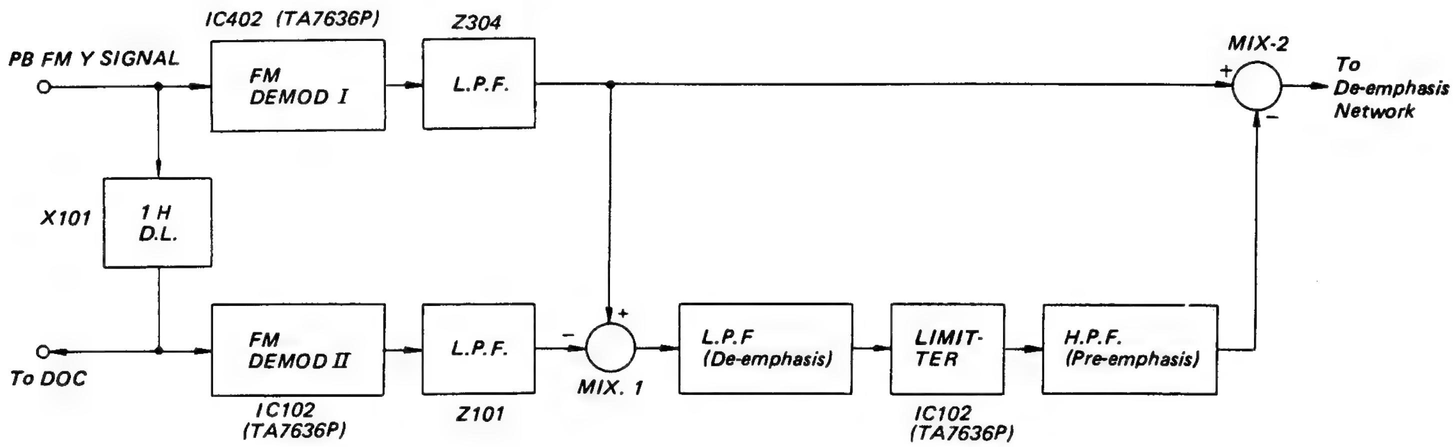
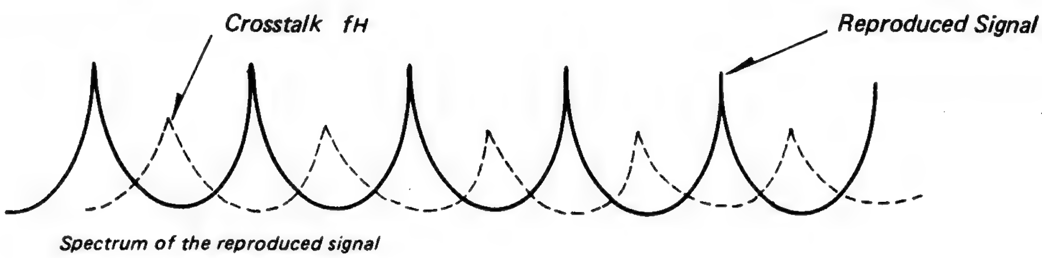
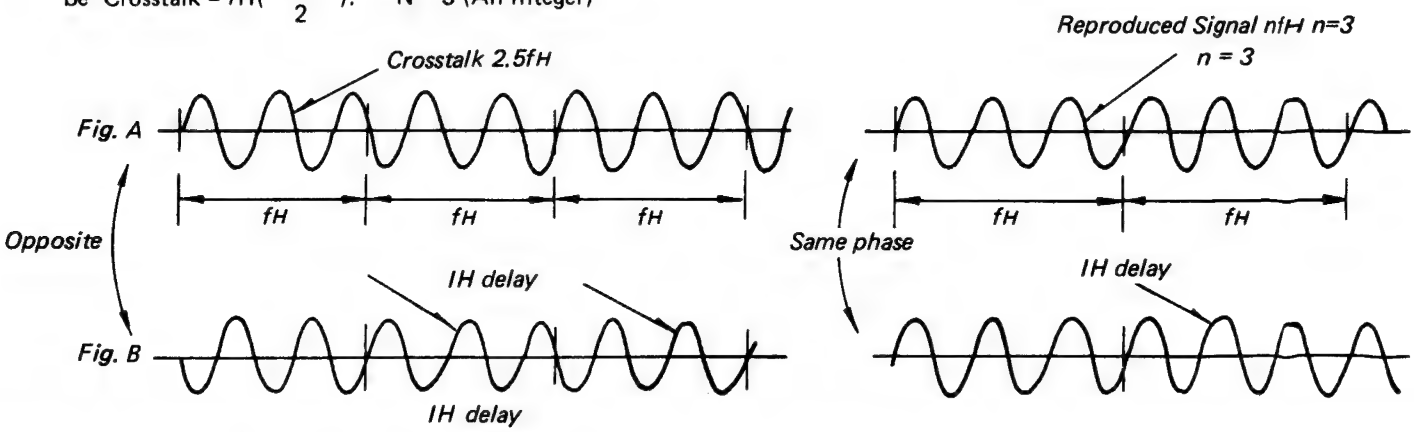


Fig. 3-10 Block Diagram of the Y Comb Type Noise Cancelling Circuit

As the carrier of the Y-FM signal of B_{CH} is shifted 1/2 fH during recording, the crosstalk during playback will be $f\text{H}(\frac{2\text{N}-1}{2})$. "N" is an integer frequency and is in relation to the frequency interleave.



If we detect this and note the crosstalk portion, it will be Crosstalk = $f\text{H}(\frac{2\text{N}-1}{2})$. N = 3 (An Integer)



Therefore, if we subtract Figure B from Figure A, twice as much crosstalk will be obtained.
If we view this with a video signal, it will appear as in Figure 3-11.

a Video Signal which is Demodulated Directly

b Video Signal which is 1 H Delayed and then Demodulated

c Crosstalk Component Obtained by Subtraction in Mixer 1

d Video Signal Obtained by Canceling out Crosstalk Component in Mixer 2

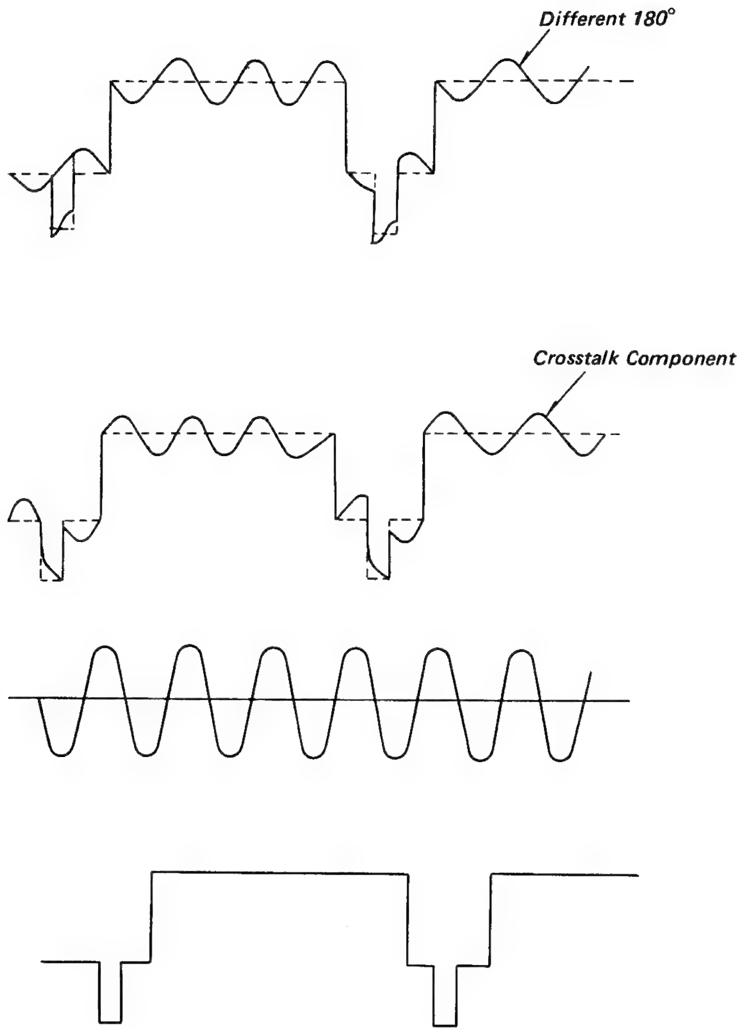


Fig. 3-11 Comb Filter Noise Canceler Circuit Video Signal and Crosstalk Signal

[Y-FM Demodulator Circuit]

The played back Y-FM signal is fed to IC101 and is amplified in IC101. This amplified Y-FM signal is fed to Pin 1 of IC402 for demodulation. The demodulated luminance signal is fed to IC102 on the Pre-amp. board through L.P.F. Z304.

Then, the luminance signal is amplified in IC102 again and is fed back to Video circuit board. TA7636P (IC402) contains the FM demodulator, de-emphasis, noise canceller, Y/C mixer, and REC/PB switch. This IC has all the active circuits from the demodulator to the video output in the playback system of this VTR. The pulse counter type and the delay line type have been used for the FM demodulation of VTRs. The demodulator in TA-7636P is multivibrator type. In this type of demodulator, a multivibrator is used as a delay circuit. An astable multivibrator is injection-locked by the Y FM signal. It is utilized that the phase difference between the multivibrator output and the input FM signal is proportional to the FM frequency. When the multivibrator is locked, the delay time of the multivibrator output against the input FM signal becomes constant without regard to its frequency.

Assume that the free running frequency of the multivibrator is Fo. If a frequency of Fo is applied, the phase difference between the input and output becomes 90 degrees. It becomes 180 degrees for a frequency of 2 Fo. This astable multivibrator is the same type as that used in the FM modulator in TA-7637P.

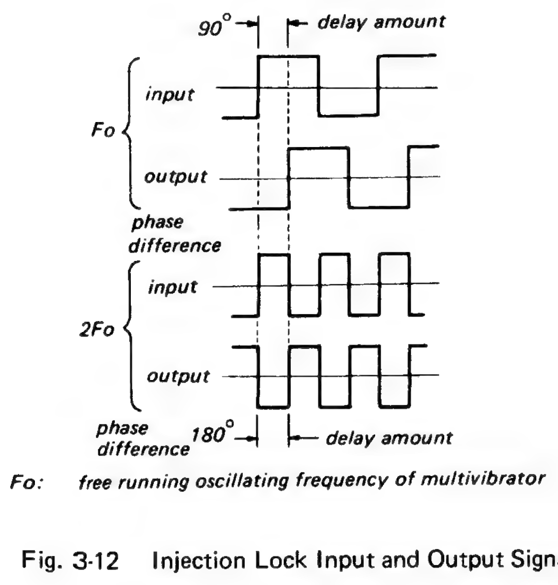


Fig. 3-12 Injection Lock Input and Output Signals

Since the phase difference between the input and output of the multivibrator is proportional to the input frequency, a detected output proportional to the frequency can be obtained by using a phase comparator (multiplier). This type of demodulator is far less sensitive to amplitude variations in the FM signal than some other demodulators previously used. This permits the use of a much simpler limiter preceding it.

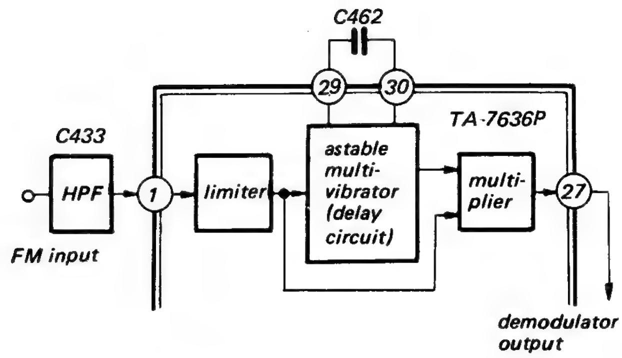


Fig. 3-13 FM Demodulator Circuit, TA-7636P

The Y FM signal from the PREAMP board is supplied to the high pass filter (C433) where its AM component is removed. Then the signal is applied to pin 1 of TA-7636P.

The FM demodulator is arranged with the limiter, multivibrator, and multiplier. The limiter limits the input FM signal and supplies it to the multivibrator and the multiplier. The multivibrator stage works as a delay circuit. The multivibrator used in the stage is the same astable multivibrator type used in the FM modulator in TA7637P. It oscillates at a free running frequency Fo, determined by capacitor C462, when no signal is applied. The FM signal is applied to this multivibrator which injection locks to it. As described previously, the phase difference between the output and input signals of the multivibrator is proportional to the input frequency. The multivibrator output and the input FM signal are both applied to the multiplier. The multiplier functions essentially as a phase comparator which develops a dc component proportional to the frequency by utilizing the fact that the phase shifts of the input and output of the multivibrator are proportional to the frequency. (See Fig. 3-14.) As shown is Fig. 3-14, the input FM signal and the multivibrator output are multiplied in the multiplier (exclusive OR circuit).

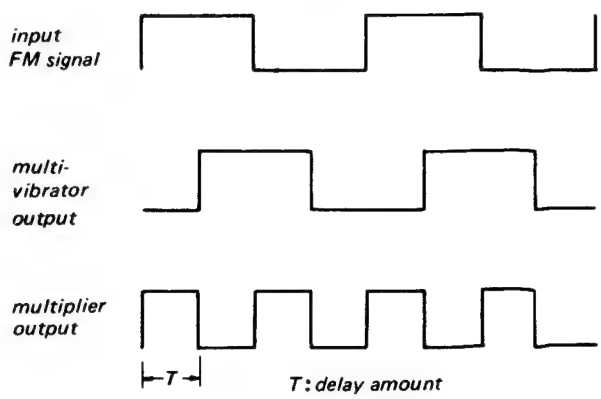


Fig. 3-14 Multipler Waveform

This multiplier is a double balanced type. The output of the multiplier is supplied from pin 27 to the following low pass filter. (See Fig. 3-15.)

The demodulated output at pin 27 goes through the low pass filter Z304 where its carrier components are rejected to Y-comb filter circuit on the PREAMP board. The crosstalk components of the luminance signal are cancelled in the Y-comb filter circuit and then, the output is fed to the base of Q416 on the VIDEO board. (See Fig. 3-15.)

The video signal goes through the emitter peaking amp (Q416), the phase correction circuit (Q415, C449, R445, and L309), the smear correction circuit (Q414), and 1/2 fH shift restoring circuit (R439, R440, R441) and is supplied to the non-linear deemphasis circuit.

The non-linear de-emphasis circuit is arranged with the de-emphasis circuit, the expand circuit and the carrier leak trap. The de-emphasis circuit and the expand circuit have the opposite characteristic against the one of the emphasis circuit and the compress circuit in the recording process.

The emitter peaking amplifier corrects the frequency characteristic around 2 MHz. The smear correction circuit corrects the clipped signal for the white and dark clip in the recording.

The video signal processed in these circuit is a high grade signal and supplied to the noise canceller circuit.

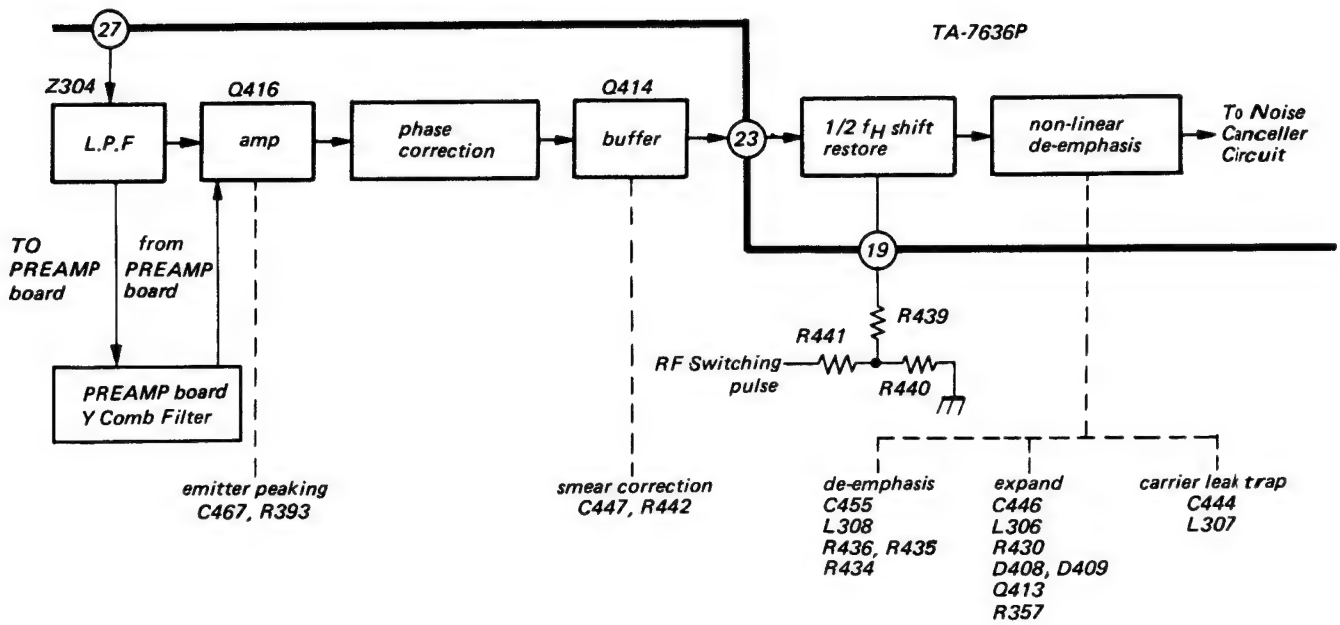


Fig. 3-15 Playback Waveform Shaper Circuit

[Noise Canceller Circuit]

The block diagram of the noise canceller is shown in Fig. 3-16.

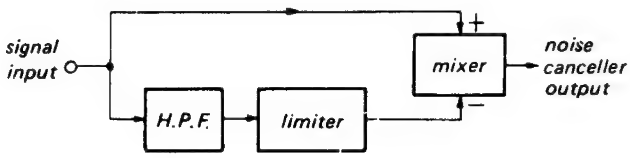


Fig. 3-16 Noise Canceller

The high frequency component in the video signal is extracted in the high pass filter and any remaining high frequency signal components are rejected in the limiter. This leaves only the high frequency noise component. This noise component is added to the video signal, 180° out of phase and the same amplitude with it. By this process, the noise component is cancelled. Fig. 3-17 shows the noise canceller circuit.

The signal applied from non-linear de-emphasis circuit is supplied to the gain adjusting amplifier. The gain of this amplifier is adjusted by varying the negative feedback from pin 14 to pin 15 with R356.

R356 determines the Playback Y signal level. The output from pin 14 is supplied to the highpass filter (consisting of C439, C438, and R420) which extracts only the high-frequency portion of the video signal. The filter output is supplied to the limiter inside the IC. The signal component with large amplitude is rejected in the limiter and the remaining is only the low amplitude noise component. The noise component is then applied to the adder circuit. The added noise component is 180° out of phase with the noise phase in the original signal and has the same amplitude with the noise amplitude in the signal. The noise component is cancelled in the addition process. The output of the noise canceller circuit is supplied to the Y/C mixer circuit in the video output stage from pin 11 via the equalizer circuit (consisting of T351, C441, and L310) and the delay line (Z303. . . 0.4 μsec).

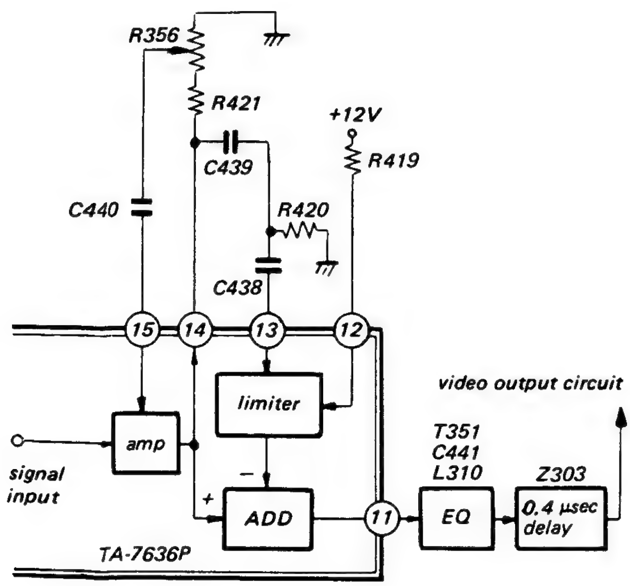


Fig. 3-17 Noise Canceller Circuit

[Test Signal Generating Circuit] TC4069UBP

When 12 V is supplied from the TEST 12 V IN, TC 4069UBP oscillates a horizontal sync frequency of 15.625 kHz and the waveform shown in Fig. 3-18 is supplied to the RF modulator from the VIDEO OUT (RF).

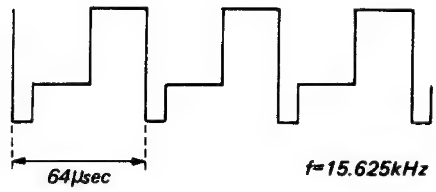


Fig. 3-18

Q412 and D415 form the switching circuit. The Test signal is supplied from the D415 side to the RF modulator only when the TEST 12 V is applied. In other modes, the signal is supplied to the RF modulator from Q412.

[Video Output Circuit in IC402 (TA7636P)]

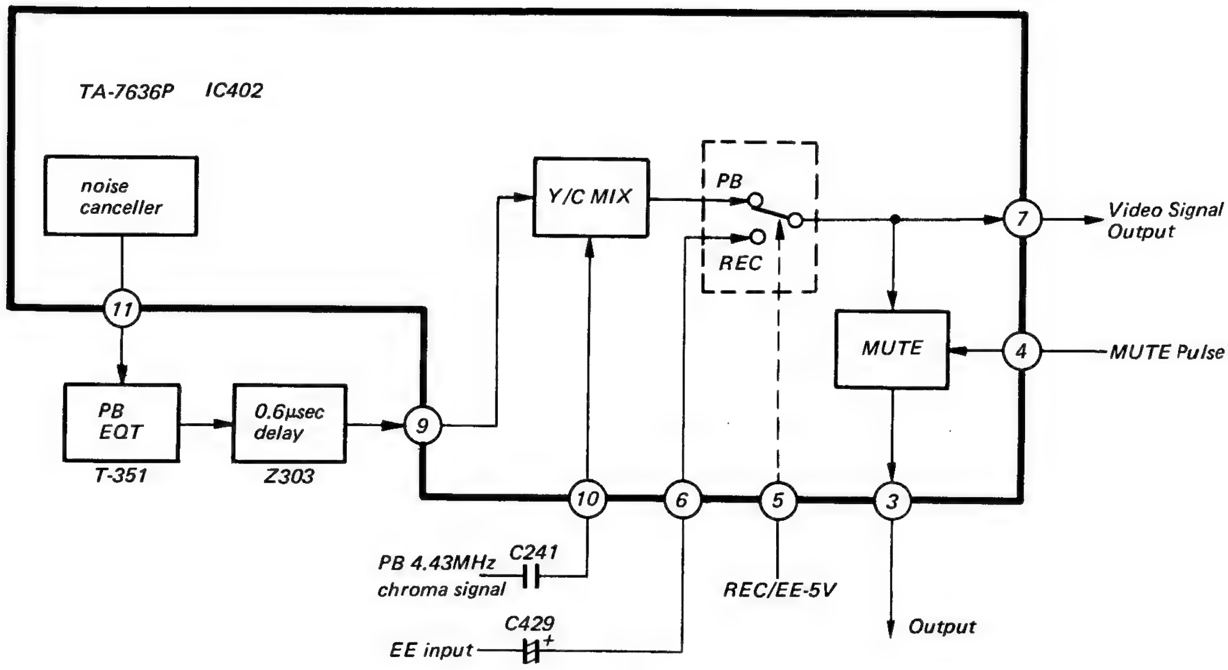


Fig. 3-19 Video Output

The video output circuit consists of the Y/C mixer, record/playback switching circuit, and muting circuit. The demodulated video signal is applied to pin 9, the input of the Y/C mixer. The playback chroma signal is applied to pin 10, and mixed with the Y. signal in the Y/C mixer. The output of the Y/C mixer is fed to the record/playback switching circuit. The direct E-E signal is applied to the record side of the switch from the AGC circuit. The signal is for monitoring the input video signal when the machine is in the REC/E-E mode. Pin 5 is the switch voltage input and 5 Vdc is applied in the REC/E-E mode. The switch is switched to REC when pin 5 is 5 V and to PB when pin 5 is 0 V.
The video output from pin 7 is supplied to the chroma system AFC circuit. The video out from pin 3 is supplied to the RF modulator via the output circuit, consisting of Q409 and Q410 and the buffer Q412, and the VIDEO OUT terminal via the output circuit (Q409, Q410).

[Output circuit]
The output signal from pin 3 of IC402 is clamped in the circuit consisting of C420, D401 and R405.
If the video signal of which level is more than 1Vp-p is fed to the RF modulator, a buzz sound will occur because of overmodulation.
To prevent it, such a high level signal is clipped by D401 (D402 is the temperature compensator for D401). The signal which has been clamped or clipped is fed to line out terminal and Logic board through buffer amplifiers Q409 and Q410.
The output for RF modulator is obtained from Q410 of which output has been divided by R410 and R411 and is fed to the RF modulator through Q412 buffer amplifier.

[Pseudo VD insertion circuit]

The pseudo VD insertion circuit inserts a stable VD with a good S/N ratio produced from RF switching pulse into the composite video signal for stabilization of the vertical direction of the picture during trick playback. In the normal playback mode, Q427 is off and Q430 and Q425 turn on. In the trick playback such as STILL, SLOW and others, trick mode signal is applied to the base of Q427, which turns on. Then, Q425 and Q430 functions as the monostable multivibrator. The switching position of RF switching pulse has been adjusted 7Hs before front porch of original VD. The insertion position of the pseudo VD is adjusted 4Hs behind.

This pulse is differentiated in the circuit consisting of C425, R412 and R413 and turns Q411 on to insert the pseudo VD to the played back composite video signal. The timing chart is shown in Fig. 3-20.

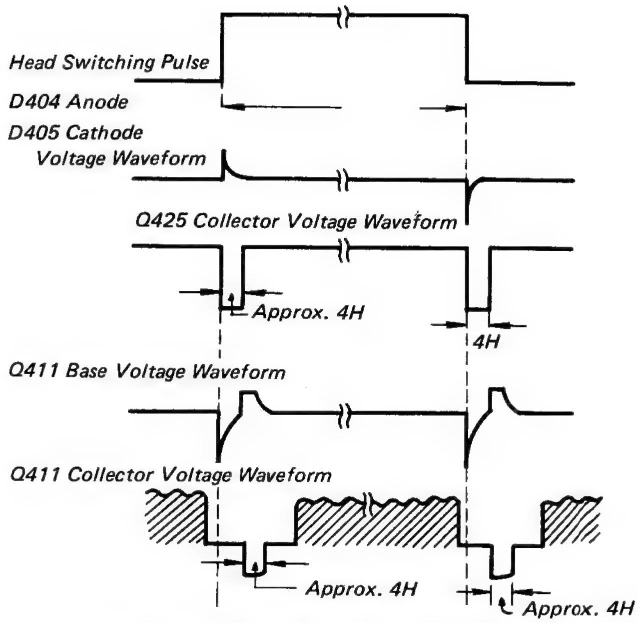


Fig. 3-20 Sync Pulse Insertion Timing Chart

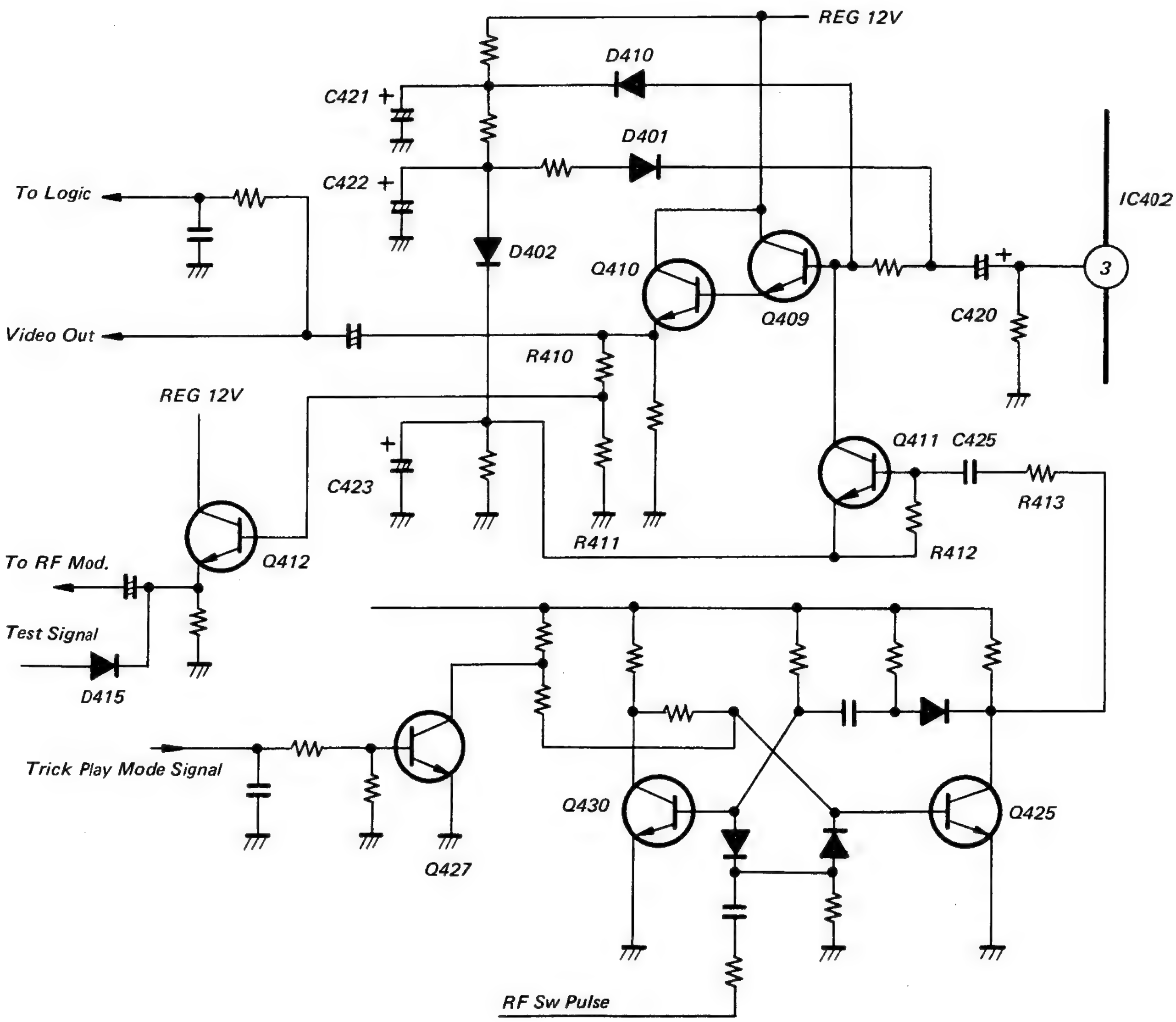


Fig. 3-21 Output Circuit and Vertical Sync Pulse Inserting Circuit

3-3 Chroma Signal System

The chroma recording system is a new system. It is identical with the former one in respect of the low-converted dc recording but the recording pattern on the tape is different. It is a new overlap record system. The detail of this system is described in Section 3-3-1 "General". The differences of the new system from the former one are the following two points.

(1) Recording is made with different chroma signal frequencies on tracks A and B. The frequency difference is 1/4 fH.

(2) The frequency of the low-converted chroma signal processed in the new AFC and APC systems synchronizes with the horizontal sync signal frequency of the input video signal.

The simplified block diagram of the chroma system is shown in Fig. 3-22.

RECORD Mode

The input 4.43 MHz chroma signal is applied to the frequency converter. The carrier signal of 4.43 MHz + (44 - 1/8) fH = 5.11 MHz in the A field and 4.43 MHz + (44 + 1/8) fH = 5.12 kHz in the B field are applied to the frequency converter.

The chroma signal is converted to the (44 - 1/8) fH = 685 kHz for the A field and the (44 + 1/8) fH = 689 kHz for the B field. These carrier signals are produced as follows. The AFC loop produces the (44 x 8 - 1) fH A field signal and the (44 x 8 + 1) B field signal in the RECORD mode from the H. sync separated from the input video signal. (The A and B fields denote the fields on which the A and B heads perform recording. The fH means the horizontal sync frequency.)

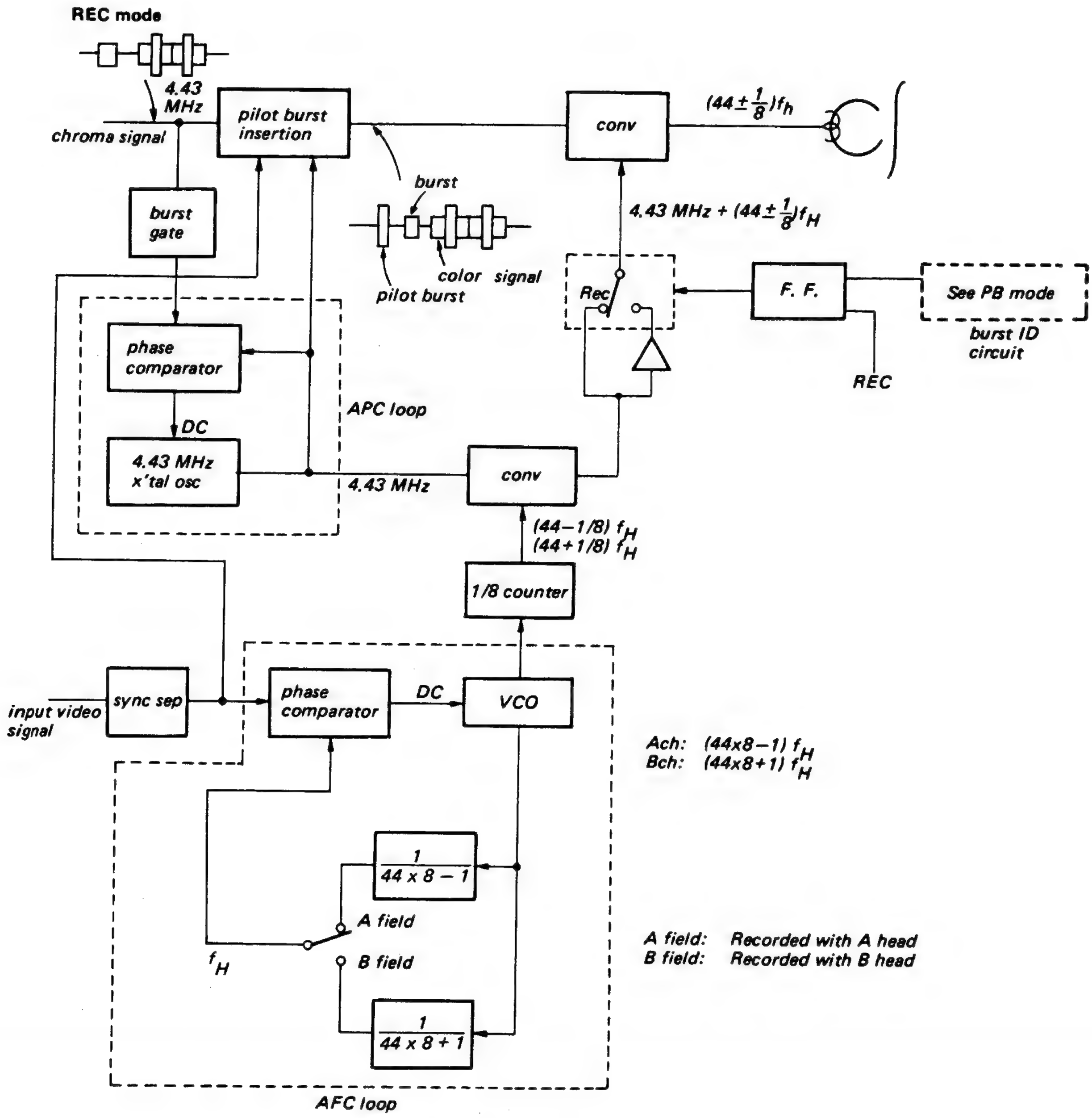


Fig. 3-22 Simplified Block Diagram of Chroma System

The AFC loop forms a PLL (= Phase Locked Loop) circuit and counts the (44 x 8 ± 1) fH outputs from the voltage controlled oscillator down to $\frac{1}{44 \times 8 \pm 1}$ compares the phase of the converted outputs with that of the H. sync, and controls the oscillator with the resultant error voltage. Thus the (44 x 8 ± 1) fH signal synchronizing with the horizontal sync signal frequency fH is obtained. The signal is divided by 8 to (44 -1/8) fH = 685 kHz for the A field and (44 +1/8) = 689 kHz for the B field and the obtained signals are applied to the frequency converter circuit. Since the 4.43 MHz crystal oscillator output is also applied to the frequency converter from the APC loop, the converter outputs are the sum frequency of the two signal, 4.43 MHz + (44 ± 1/8) fH = 5.119 MHz (for A field) and 5.123 MHz (for B field).
The 5.119 MHz and the 5.123 MHz outputs are supplied to the chroma frequency converter. The resulted chroma signal frequencies converted to 685 kHz and 689 kHz are recorded. The chroma frequencies are synchronized to fH, horizontal sync signal frequency and have the relationship of the (44 -1/8) fH and the (44 + 1/8) fH. The APC loop compares the phase of the 4.43 MHz variable crystal oscillator output with that of the burst signal to control the variable crystal oscillator with the obtained error voltage. Therefore the phase relationship between the 4.43 MHz output and the burst signal is kept constant.

The circuit to insert the 4.43 MHz output into the horizontal sync signal section of the input chroma signal is a pilot burst insertion circuit. Since the pilot burst signal is recorded about 6 dB larger than the original burst signal, it is utilized in the APC (= Automatic Phase Control) in the PLAYBACK mode because of the improved S/N ratio.
The low-converted chroma signals of 685 kHz and 689 kHz are recorded on the tape together with the frequency-modulated luminance signal.

PLAYBACK Mode

The (44 -1/8) fH 685 kHz and the (44 +1/8) fH chroma signals separated from the playback output from the video head are converted to 4.43 MHz in the frequency converter. The 4.43 MHz + (44 -1/8) fH = 5.119 MHz and the 4.43 MHz + (44 + 1/8) fH = 5.123 MHz carrier signals are applied from the same circuit used in the RECORD mode. The input signal to the APC loop in the PLAYBACK mode is the horizontal sync signal separated from the playback video signal. The 4.43 MHz variable frequency crystal oscillator is controlled by APC loop output.
The chroma signal was recorded with the (44 ±1/8) fH frequency synchronized with horizontal sync signal fH. When the signal recorded in such a way is played back, the relationship between phase variation Y of the horizontal sync signal of the playback video signal and phase variation X of the playback chroma signal is X = (44 ±1/8) Y. The AFC loop produces the (44 ± 1/8) fH output synchronizing with the playback sync

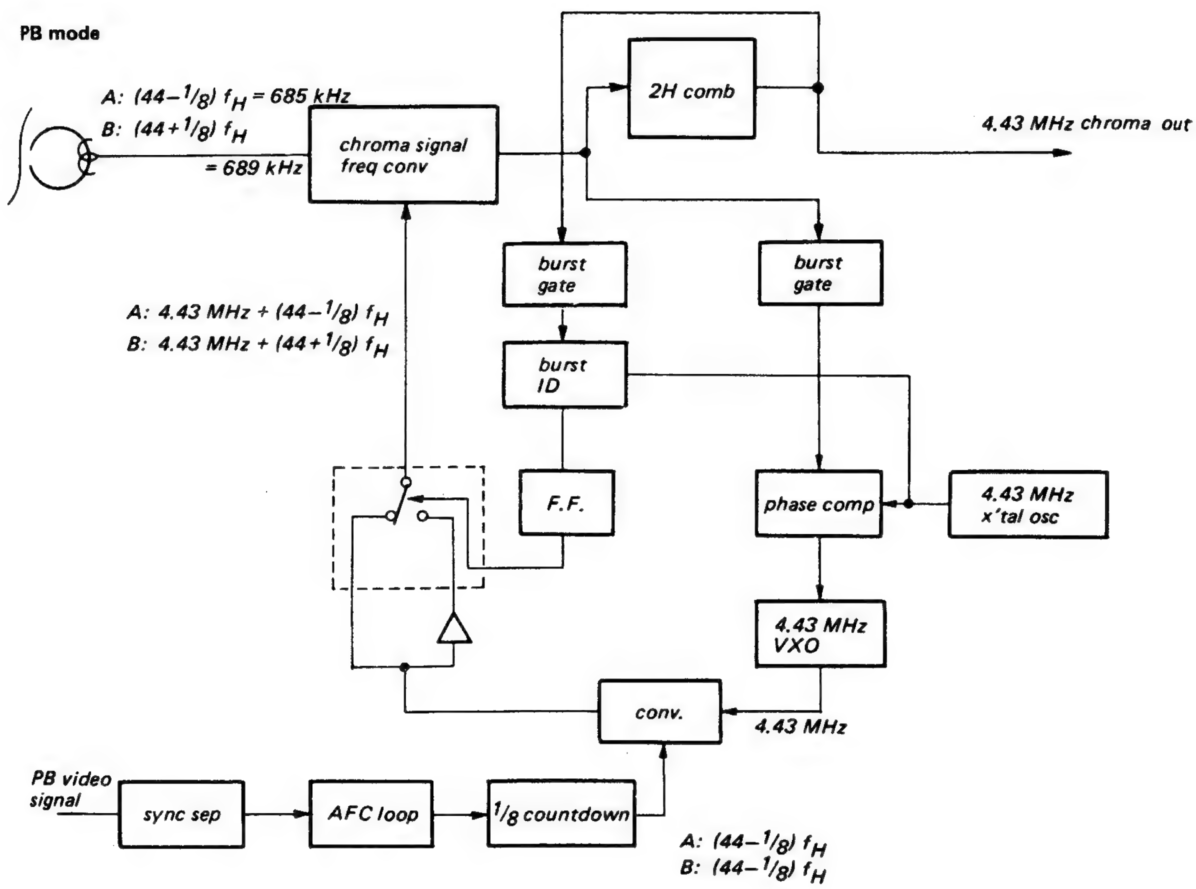


Fig. 3-23

signal. The output contains the phase variation component equal to that in the chroma signal. The phase variation in the chroma signal is cancelled in the frequency conversion process and the 4.43 MHz chroma signal with a stable phase is obtained. The phase variation of the chroma signal is almost removed only in the AFC loop, i.e., the horizontal sync signal is utilized as the pilot signal.
The APC loop is used to remove more small phase variations. The 4.43 MHz pilot burst signal was inserted into the horizontal sync portion in the recording. In the PLAYBACK mode, the phase of the pilot burst signal of the chroma signal converted to 4.43 MHz is compared with that of the 4.43 MHz crystal oscillator output to obtain the error voltage for controlling the 4.43 MHz variable frequency oscillator. Thus the phase of the playback chroma signal is stabilized. Since the APC loop does not work properly in such a case that the phase of the playback chroma signal inverts 180°, the burst ID circuit shown in the figure is provided for prevention of the disorder due to the 180° inversion. The circuit compares the phase of the 4.43 MHz crystal oscillator output with that of the pilot burst signal and when the phase inversion of the pilot burst signal is detected, it feeds a trigger to the flip-flop to restore the switch phase to the normal state.
The crosstalk from the adjacent tracks to the playback chroma signal is removed in the 2 H comb filter.

The above is a brief explanation of the colour recording system and the detail of each section is described below.
The chroma signal process circuit is on the VIDEO board. It is arranged with 7 ICs [CX136A, CX832, CX150 (two), and CX130 (two)] and TTL IC [MB14300].

CX136A contains the chroma process circuit for record and playback, the APC circuit, the AFC circuit, and the two frequency process circuits, and supplies the carrier signal to the frequency converter circuit of the chroma signal.

[Chroma Signal Process] CX136A
IC201, CX136A used for both the record and playback as the chroma signal process circuit functions as the ACC (= Automatic Chroma Level Control), the frequency conversion, and the color killer.
The switching of the record and the playback is performed by the external switching circuit consisting of Q213, Q214, Q221, and Q222.

Record System Chroma Signal Process
The block diagram of the record system chroma signal process and its peripheral circuit are shown in Fig. 3-25.

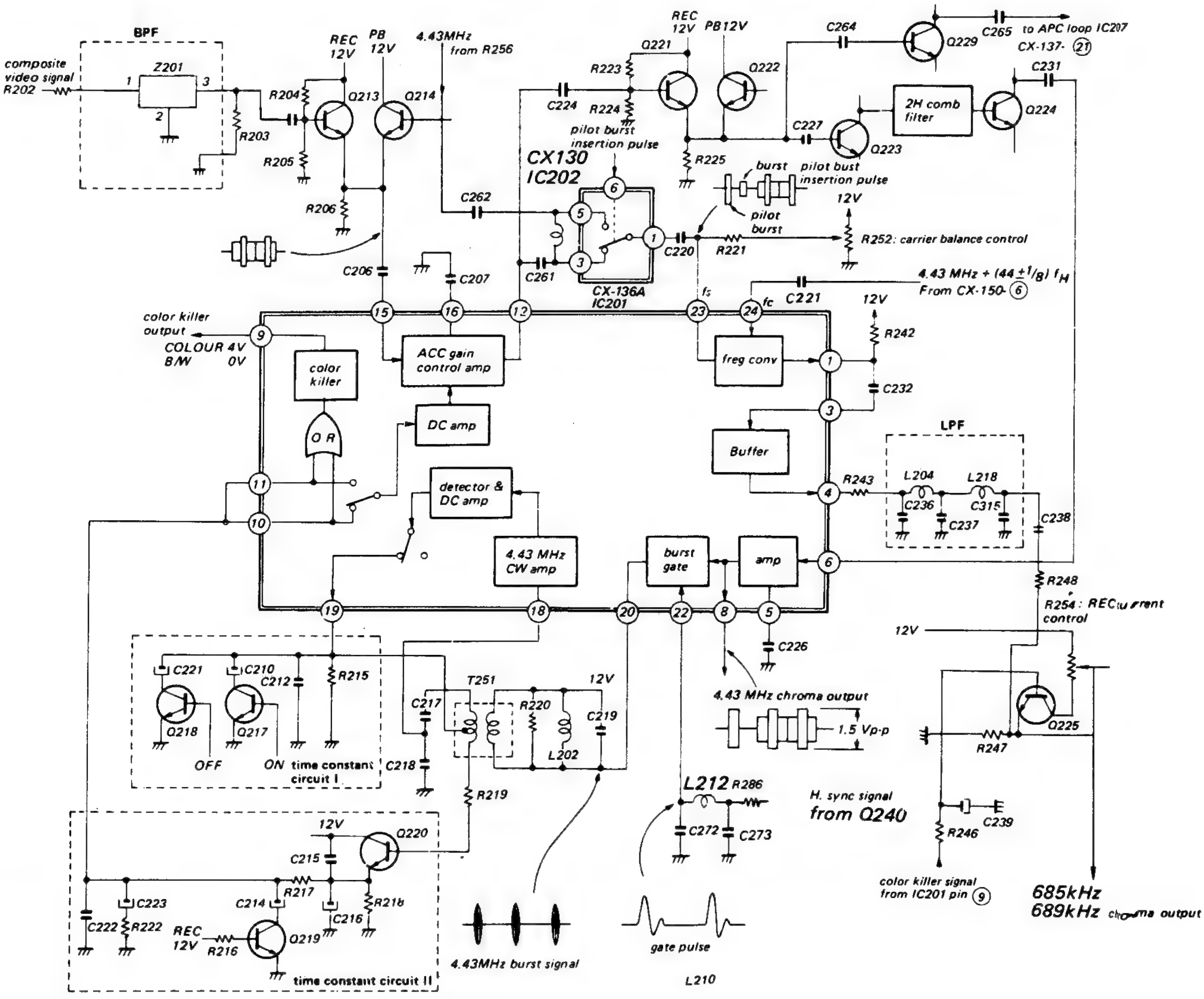


Fig. 3-24

The composite video signal supplied to the VIDEO board is fed into two paths. One is fed to the AGC circuit (in TA7637P) and the other to the chroma process circuit via the band pass filter. The band pass filter (Z201) extracts only the 4.43 MHz chroma portion. The extracted chroma signal enters the ACC gain control amplifier (pin 15) via Q213. Since Q213, Q214 form a switching circuit and a voltage is applied to the Q214 circuit in the PLAYBACK mode, the Q214 side cuts off in the RECORD mode. The DC voltage made by detecting the burst signal in the latter stage is applied to the ACC gain control amplifier for a constant burst signal level. C207 connected to pin 16 is a decoupling capacitor. The ACC output (pin 12) is supplied both to the pilot burst insertion circuit (pin 3 of CX130) and transistor switch circuit Q221.
The chroma signal supplied to the switching circuit goes to the circuit for producing the control DC voltage of the ACC gain control amplifier. Since the Q222 is biased in the PLAYBACK mode, Q222 cut off in the RECORD mode. The 4.43 MHz chroma signal takes two different paths after is passed the Q221. One goes to the APC loop and the other to the 2 H comb filter. The S/N ratio of the 4.43 MHz chroma signal improved by 3 dB. The signal is supplied to the burst gate circuit from pin 6 via the output amplifier. The output amplifier amplifies the chroma signal up to a sufficient level to drive the ACC detect circuit. C226 connected to pin 5 is a decoupling capacitor. A burst gate pulse is applied from pin 22 to the burst gate circuit where the burst signal is extracted. The burst gate pulse is produced by delaying the H. sync in the low pass filter (C272, L212, C273). The extracted burst signal enters the resonance circuit (C219, L202 and T251) from pin 20 to be only the 4.43 MHz portion. The secondary of the burst amplifier transformer (T251) is connected to ground from the viewpoint of AC to obtain two outputs.
One of the outputs is divided by C217 and C218 and enters the detector circuit via the 4.43 MHz CW amplifier from pin 18. The ACC detector circuit processes the 4.43 MHz burst signal for a peak detection and compares the burst signal with the reference signal to obtain an error voltage.
The detected output enters external time constant circuit I from pin 19 and converted to a DC voltage. Q217 is ON and Q218 OFF in the RECORD mode. The time constant circuit is arranged with R215, C212, and C210. The DC voltage filtered in time constant circuit I, goes to R219 from the mid point of T251 and becomes the bias for Q220. The burst signal from T251 is added to Q220 and the resultant voltage enters time constant circuit II. The detected DC voltage goes to the DC amplifier from pins 10 and 11 to control the gain of the ACC gain control. Since this DC voltage corresponds to the input burst level, an ACC loop is formed. When the chroma input is small, the operational DC voltages at pins 10 and 11 decrease so that the ACC amplifier gain becomes larger. The input level is set by changing the pin 17.
The DC voltages from pins 10 and 11 are applied to the colour killer stage to operate the colour killer through the OR gate. The ACC loop is designed so that it works even if the ACC loop locks out. When the ACC loop locks out and the ACC output level lowers approx. 1 dB below the reference, the colour killler operates. The input chroma signal level is 20 dB higher than the colour killer operation level. A hysteresis characteristic is provided for increasing stability around the colour killer operational point. The colour killer output is applied to the pilot burst cleaning circuit IC203 and colour killer functions the pilot burst cleaning circuit at all periode to cut the chroma signal in the B/W mode. The colour killer signal from pin 9 is 4 V in the colour mode and 0 V in the B/W mode. The signal serves for various purposes. The detail will be described in Fig. 3-24.
The 4.43 MHz chroma signal entered the pilot burst insertion circuit (pin 3 of IC202, CX130) from pin 12. The switch circuit (IC202) is a circuit to insert the pilot burst signal. The pilot burst signal produces the 4.43 MHz pilot burst which is phase-locked to the input burst signal. The inserted range is approx. 3 μsec. in the horizontal signal portion and its level is 6 dB higher than the one of the normal one.
The 4.43 MHz chroma signal into which the pilot burst was inserted enters the frequency converter from pin 23 and is low-converted. The frequency converter is arranged with a balanced modulator. When two inputs of fs (4.43 MHz) and fc (A field, 5.119 MHz; B field, 5.123 MHz) are applied to the balanced modulator, the sum of the two frequencies (A, 9.549 MHz; B, 9.553 MHz) and the difference (A, 685 kHz; B, 689 kHz) are obtained as the outputs. If the difference is filtered in a filter, the 4.43 MHz chroma signal is converted to the low range frequency (fc-fs), i.e., 685 kHz for the A field and 689 kHz for the B field. As the signal flow on the schematic diagram, the frequency converter output goes from pin 1 to pin 3, a buffer in IC, pin 4, LPF where it becomes the low-converted chroma signal, and enters amplifier Q225. Q225 works as an amplifier in the colour mode and as a switching circuit to cut off in B/W mode. The output signal from Q225 is adjusted by R254, and is fed to pin 1 of IC209.

Playback Chroma Process

In the PLAYBACK mode the playback RF signal is supplied to the chroma process circuit from CX134A, RF playback amplifier, on the Preamp BOARD. The block diagram and the peripheral circuit of the playback chroma process circuit CX136A are shown in Fig. 3-25. The Y FM signal involved in the playback RF signal is removed in a low pass filter so that the low frequency chroma signals of 685 kHz and 689 kHz are extracted. In the PLAYBACK mode, a voltage is supplied to the Q214 and Q213 side cuts off. The chroma signal enters the ACC gain control amplifier from pin 15. The DC voltage detected the burst signal in the latter stage is applied to the gain control amplifier for a constant burst signal level. Since the hold circuit for the ACC detection output is provided for each of the channels, the ACC loop is independent for each of the A-CH and B-CH so that the difference in the output levels is hardly recognized even if a level difference between the channels is large.

Playback System Chroma Signal Process

The RF switch pulse turns on Q218 of the A-CH and C211 is the capacitor of the time constant circuit I. Q217 is OFF during Q218 is ON and the B-CH potential is held in C210. When the channel is switched, Q217 turns ON and the gain is controlled by the voltage held in C210. Since each channel is independent, the level difference in the outputs is hardly recognized even if there is a level difference in the channel inputs. The level difference in the outputs does not come out because the ACC loop contains a frequency converter, comb filter, and output amplifier.

The operation of the ACC was described in "Record System Chroma Signal Process".

The low frequency range chroma signal is supplied to pin 3 of IC202 from pin 12 after it passes the ACC gain control amplifier and outputted from pin 1 of IC202. Switch IC202 is connected to the pin 3 side in the PLAYBACK mode. The low frequency range chroma signal applied to pin 23 is low-converted by the converting carrier from pin 24 in the IC and outputted from pin 1. The signal from pin 1 goes through buffer (input . . . pin 3 and output . . . pin 4) and then to the bandpass filter. Thus the 4.43 MHz chroma signal is obtained.

The frequency converter input to pin 23 is the (44 - 1/8) fH = 685 kHz in the A field and the (44 +1/8) fH = 689 kHz in the B field. The conversion carrier to pin 24 is the 4.43 MHz + (44 -1/8) fH = 5.119 MHz for the A field and the 4.43 MHz + (44 +1/8) fH = 5.123 MHz for the B field. The frequencies are supplied in synchronization in each field and processed for the balanced modulation. Then the sum of the frequencies, 4.43 MHz + 2 (44 ±1/8) fH, and the difference, 4.43 MHz, are obtained as the outputs as well as in the RECORD mode. Only the 4.43 MHz component can be extracted from these signals with the help of the bandpass filter. Since the output frequency and the carrier frequency are close in the frequency conversion and a carrier leak is caused when the converter balance is poor, R252 is provided for the balance adjustment.

The 4.43 MHz chroma signal passes the switch circuit consisting of Q222, is amplified in Q223, and enters the comb filter. In the PLAYBACK mode, Q221 is OFF.

The playback chroma signal contains the crosstalk component from the adjacent tracks due to the overlap recording and the crosstalk component is eliminated in the comb filter.

The subtraction of the 2 H delay line output and the non-delayed signal in the comb filter. Since both the signals flow through R238 and the 4.43 MHz chroma signal flows in the same direction as shown in the figure, the output is doubled. As the crosstalk component flows in the opposite direction and is cancelled, the output becomes zero. The chroma signal whose crosstalk component was removed is amplified in Q224 and supplied to the output amplifier (pin 6 of IC201). The insertion loss in the delay line is amplified in Q223 and Q224 so the signal levels of the Q223 base and the Q224 collector are almost equal. The signal supplied to pin 6 of IC201 takes two paths. One goes to the burst gate to be the ACC control voltage as described previously and the other takes two different paths. One passes the 1 H delay line (IC204) in the STILL mode and enters the Y/C mix circuit. The other goes to the carrier signal phase inversion and the burst ID circuits.

[AFC and APC Circuits] CX832

IC207 (CX832) contains the AFC and APC circuits.

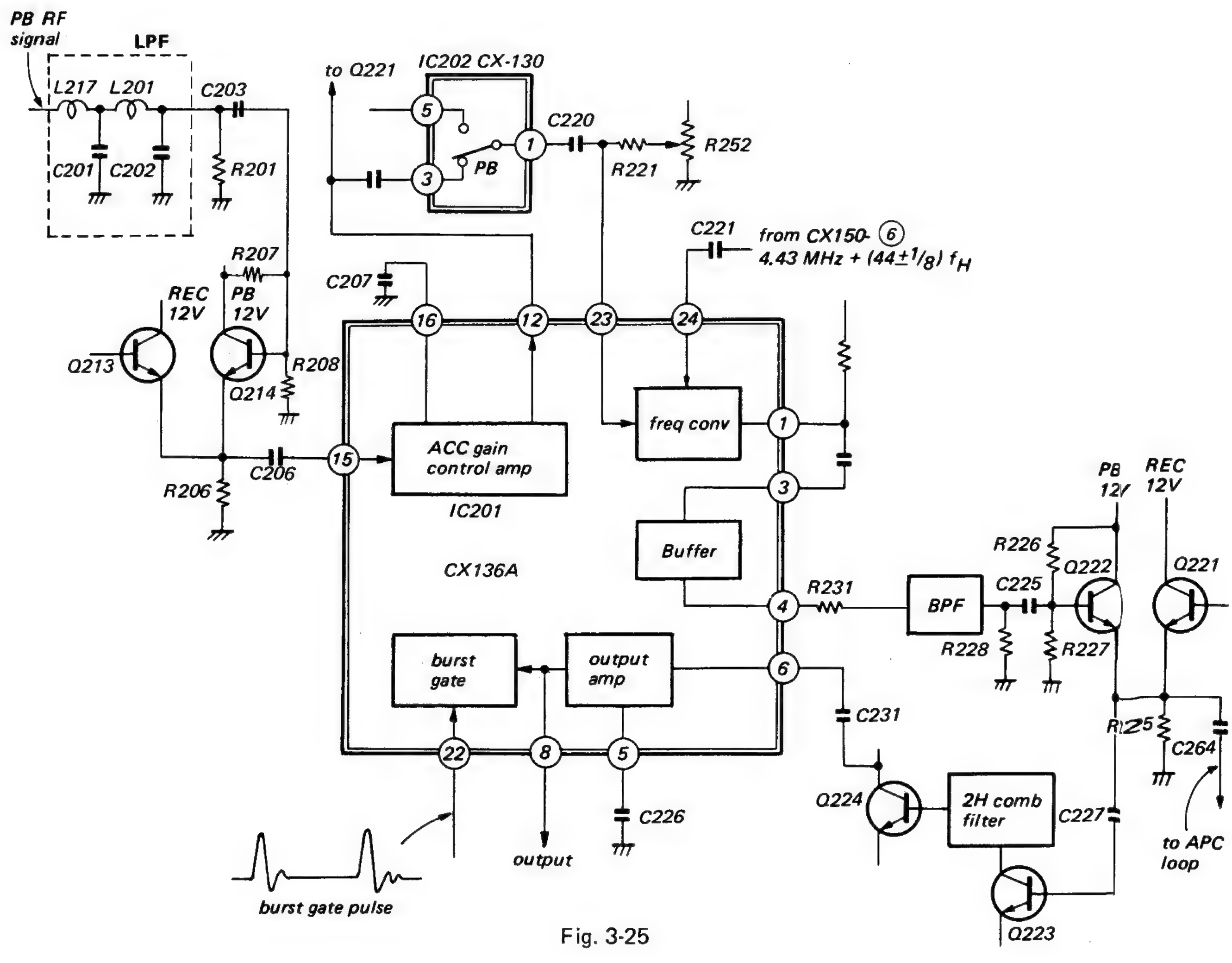


Fig. 3-25

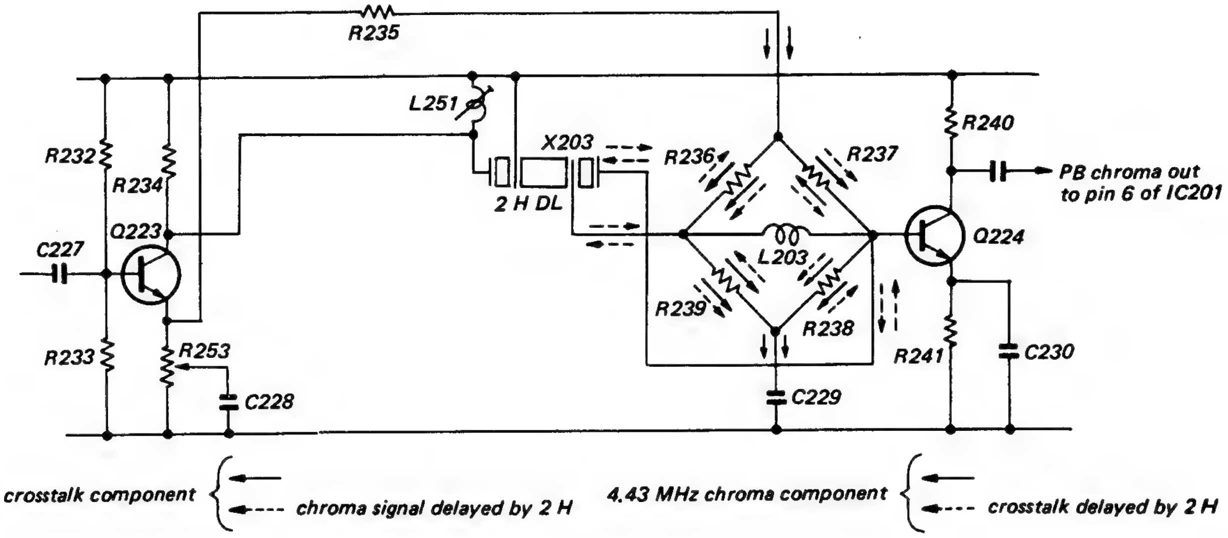


Fig. 3-26

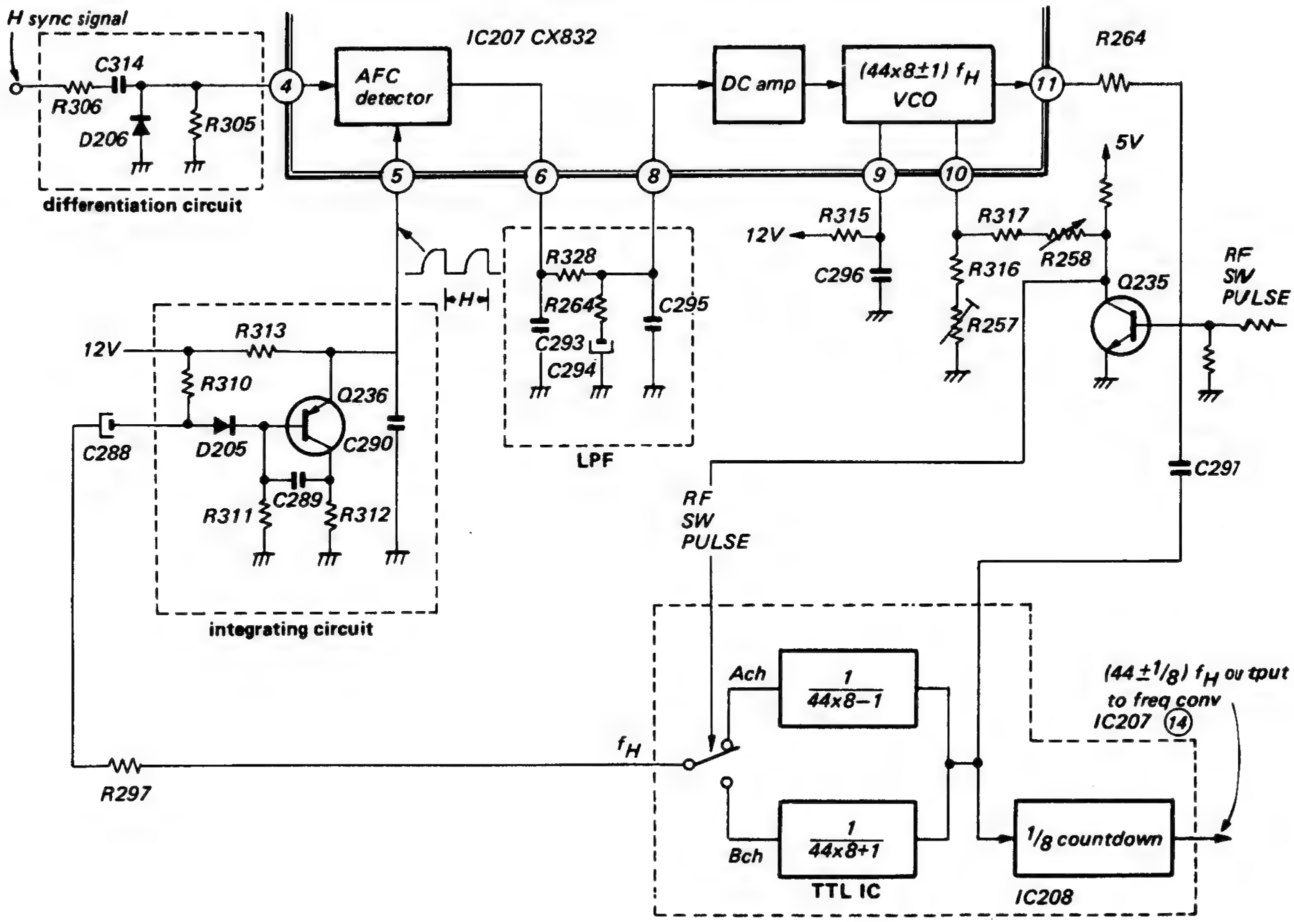


Fig. 3-27

AFC Circuit
The AFC circuit divides the signal, which is made by multiplying the H. sync signal by (44 x 8 ± 1) in both the record and playback, into 8, obtaining the CW signals of 685 kHz = (44 - 1/8) fH and 689 kHz = (44 + 1/8) fH. The PLL (=Phase Locked Loop) is utilized for the (44 x 8 ± 1) multiplication and it is called AFC in relation to the TV receiver because the H. sync signal is used.

The AFC circuit is shown in Fig. 3-27. The 44 x 8 ± 1 counting down circuit in the AFC loop comprises TTL, IC208.
The waveform of each section is shown in Fig. 3-28.

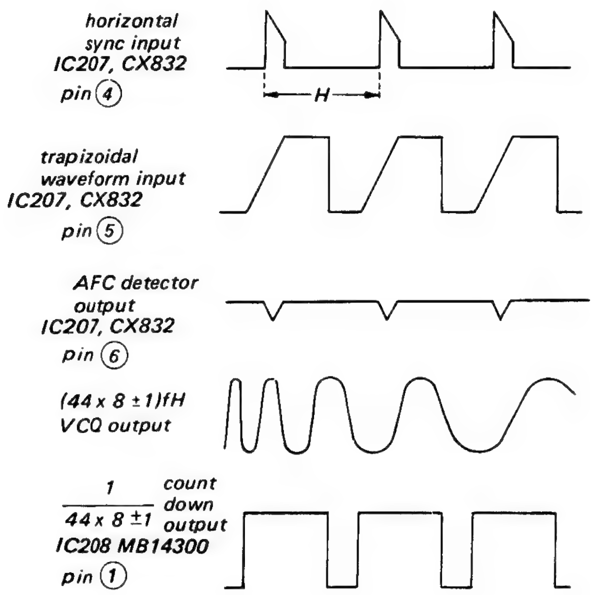


Fig. 3-28

The AFC detection circuit is a sampling hold circuit. It samples the trapezoidal waveform applied to pin 5 with the H. sync pulse applied to pin 4 for the phase detection. The detected output goes the low pass filter (consisting of C293, C294, C295, R328, R314) from pin 6 and enters the DC amplifier from pin 8. The DC amplifier output controls the oscillating frequency of VCO (= Voltage Controlled Oscillator) to obtain the (44 x 8 ± 1) oscillating output. The oscillating circuit is a multivibrator oscillator arranged with C and R. The oscillating frequency is determined by R315 and C296 connected pin 9. The discharge current of the multivibrator is varied with R257 for controlling the oscillating frequency. The frequency is (44 x 8 - 1) fH in the A-CH and (44 x 8 + 1) fH in the B-CH. Since the oscillating frequencies are different between the channels, a difference is produced in the AFC detection output. The difference is corrected with R258 so that the AFC lock points for the A-CH and B-CH position at the center of the slope of the trapezoidal wave form.

The oscillated frequency is divided into 44 x 8 – 1 in the A-CH and 44 x 8 + 1 in the B-CH in the counter circuit of TTL which will be described later. Thus the fH outputs for the A- and B-CH are obtained. Since the counted down output is a rectangular wave form, it is wave-shaped in the Q236 and the peripheral CR circuit to a trapezoidal wave form and supplied to the AFC detection circuit in IC207, CX832. The (44 x 8 ± 1) fH VCO output synchronizing with the H. sync frequency is obtained in the AFC loop explained above. The VCO output is counted down to 1/8 in IC208 to be (44 ± 1/8)fH, converted to the sum frequency with 4.433619 MHz crystal oscillator output, and supplied to the chroma signal frequency converter circuit.

[APC Circuit] CX832
The APC (= Automatic Phase Control) operation is different a little in the record and the playback. It is switched by the external circuit. The block diagram of the APC is shown in Fig. 3-29.
The APC circuit comprises the phase detector circuit, reactance circuit, 4.43 MHz variable crystal oscillator (hereinafter called "VXO"), burst gate circuit, and 4.43 MHz crystal oscillator circuit oscillating the reference phase. The frequency converter to supply the carrier signal to the chroma signal frequency converter circuit is included in IC207, CX832. The reactance circuit is a variable capacitance type and connected to the 4.43 MHz variable crystal oscillator as the oscillation constant. The phase detector is connected to the reactance circuit which produces the 4.43 MHz VXO output whose frequency is controlled by the phase detector output. The VXO output is fed to the frequency converter where it is added to the (44 ±1/8) fH VCO output and converted to a frequency of 4.43 MHz + (44 ±1/8) fH. This output passes the band pass filter (Z203) from pin 15 and is supplied to the chroma frequency converter (CX136A) for the record and the playback via CX150.
The 4.43 MHz input chroma signal is supplied to the APC detection circuit in the RECORD mode as the reference signal from pin 21.
The 4.43 MHz VXO output is supplied to pin 23 via Q239 as a comparison signal. (The Q238 and Q239 circuit forms the switch circuit of the REC/PB. Q239 operates in the RECORD mode and Q238 in the PLAYBACK mode. That is the phase of the 4.43 MHz VXO output is compared with the one of the reference signal, the burst of the 4.43 MHz chroma output. The detected output is filtered in the CR filter connected to pins 20 and 22 and supplied to the VXO where the 4.43 MHz frequency is controlled. The phase-locked 4.43 MHz is supplied to the pilot burst insertion circuit via the phase shifter (consisting of L213, C300, C299). Since the phase comparison is performed with the burst signal, the operation of the phase detection circuit is controlled with the burst gate circuit so that the APC phase detector output appears only in the burst period. A burst gate pulse is produced by delaying the horizontal sync in the delay circuit (L212, C273, C272). In the RECORD mode the gate pulse on the D203 side is supplied to pin 24.
In the PLAYBACK mode the PB 4.43 MHz chroma signal is supplied to the phase detector circuit from pin 21. The reference signal is supplied from the 4.43 MHz crystal oscillator arranged between pins 19 and 23. (Q238 is ON and Q239 OFF.) The burst of the 4.43 MHz chroma signal is compared with the phase of the reference 4.43 MHz.

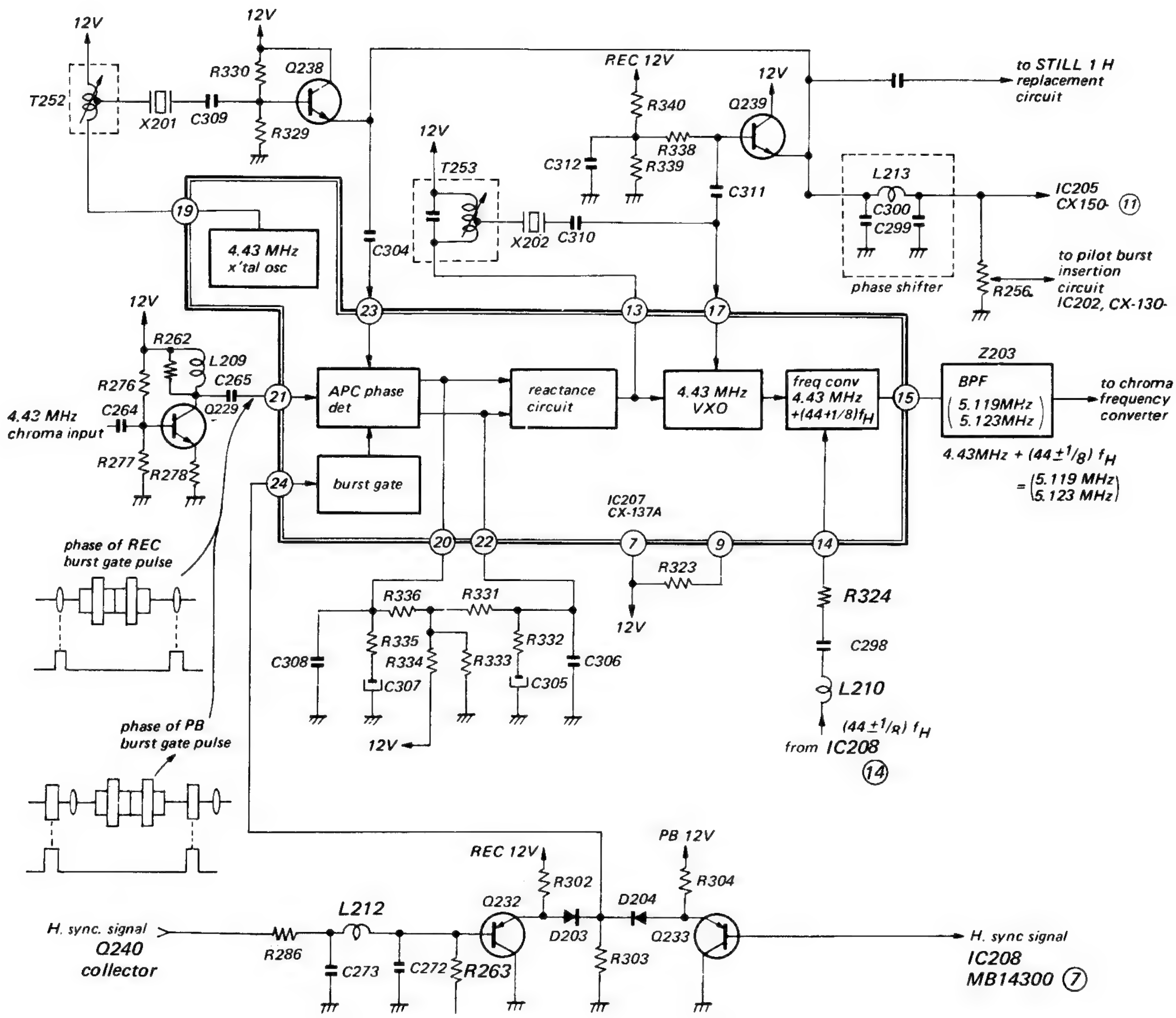


Fig. 3-29

This detected output is filtered as well as in the RECORD mode and supplied to the VXO. The burst gate pulse in the PLAY mode is supplied to pin 24 from the D204 side with the timing of the gating the pilot burst signal inserted into the horizontal period in the RECORD mode.

The APC function can be summarized as follows. The APC circuit produces the phase-locked 4.43 MHz signal for the pilot burst in the RECORD mode and removes the phase variation component caused by jitters in the PLAY mode, obtaining the 4.43 MHz chroma signal having phase stability.

[1/(44 x 8 ± 1) Countdown circuit (MB14300)]

IC208 (MB14300) is a TTL digital IC and contains 1/(44 x 8 ± 1) countdown circuit which consists of AFC loop and 1/8 countdown circuit.
Further it contains three circuit sections which are HD pulse generator, pilot burst cleaning pulse generator and burst gate pulse generator which triggers the burst signal every 2H periods.
Block diagram is shown in Fig. 3-31 and Timing chart is shown in Fig. 3-30.
VCO output signal (44 x 8 ± 1) fH from pin 11 of IC207 is applied to pin 9 of IC208 and is amplified.
The output signal from pin 11 of IC208 (waveform is shown in Fig. 3-30 (A)) is fed to the 1/(44 x 8 ± 1) countdown stage through pin 12.
The countdown ratio is controlled by the RF switching pulse which is applied to pin 4 of IC208. In the case of A channel RF switching pulse, it is set to 1/(44 x 8 – 1) = 1/351, and in B channel, 1/(44 x 8 + 1) = 1/353.
The output of the countdown circuit which waveform is shown in Fig. 3-30 (B) is fed to AFC detector through the integrator (waveform is shown in Fig. 3-30(E)).

[HD pulse generator, pilot burst cleaning pulse generator and 2H burst gate pulse generator]

These circuits are comprised of IC208 and the peripheral circuit of IC.
The video signal in recording and playback modes is fed from pin 7 of IC402 to the sync separator circuit consisting of Q240, C282 and R294.
The output of sync separator of which waveform is shown in Fig. 3-30(E) is fed to pin 6 of IC208, HD pulse generator where the equalizing pulses are removed and HD pulse (3μs) is output from pin 7 of IC208. (waveform is shown in Fig. 3-30(F))
The output from pin 7 is applied through differential circuit to IC207 AFC loop and to pin 6 of IC202 for pilot burst insertion during Recording and also is used for pilot burst cleaning during playback mode. On the other hand, the composite sync signal is fed to delay circuit consisting of C273, L212 and C272 to use as a burst gate pulse.
The pilot burst cleaning pulse is output from pin 15 of IC208. (waveform is shown in Fig. 3-30 (C)).
This output is an open-collector output.
When the level of pin 15 of IC208, or collector of Q230 or D202 is decreased the same as GND level, the level of pin 6 of IC203 is GND level.
fH output from pin 1 of IC208 is applied to 1/2 countdown circuit from pin 2.
1/2 counted down output is fed out from pin 3, which is an open-collector output and produces the 2H burst gate pulse by shorting the R322 to GND every 2H.

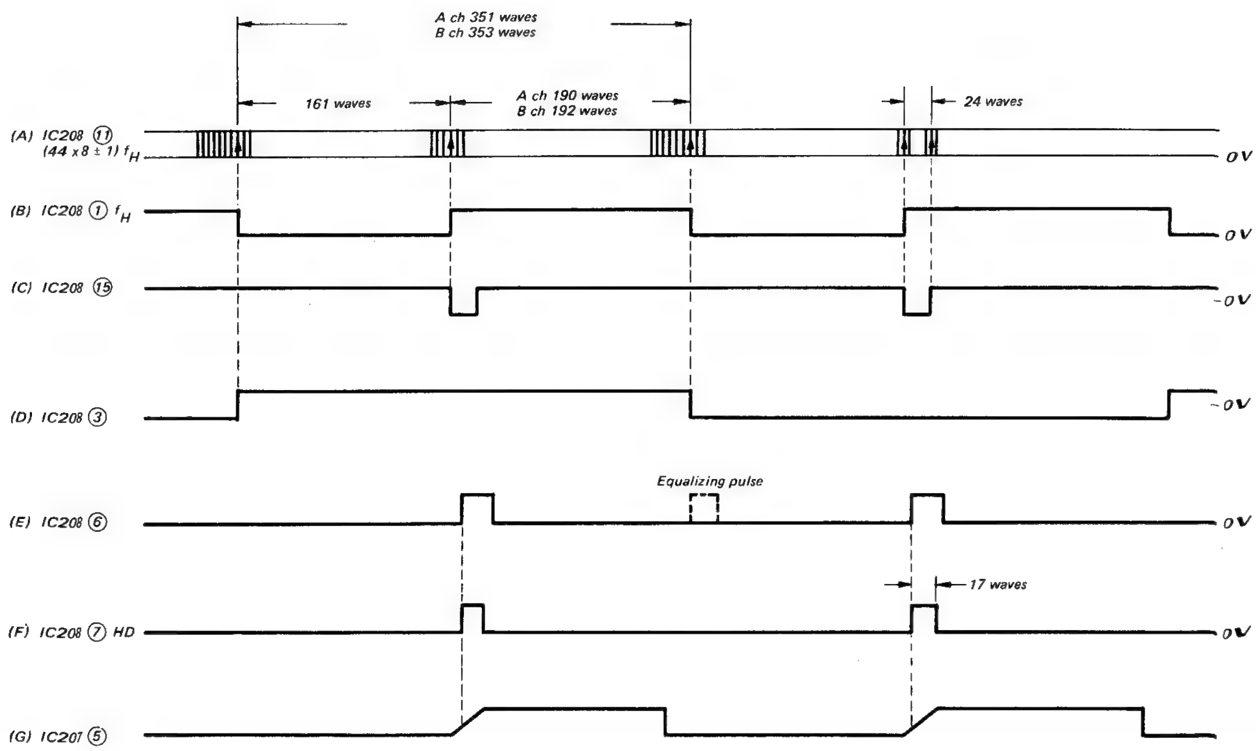
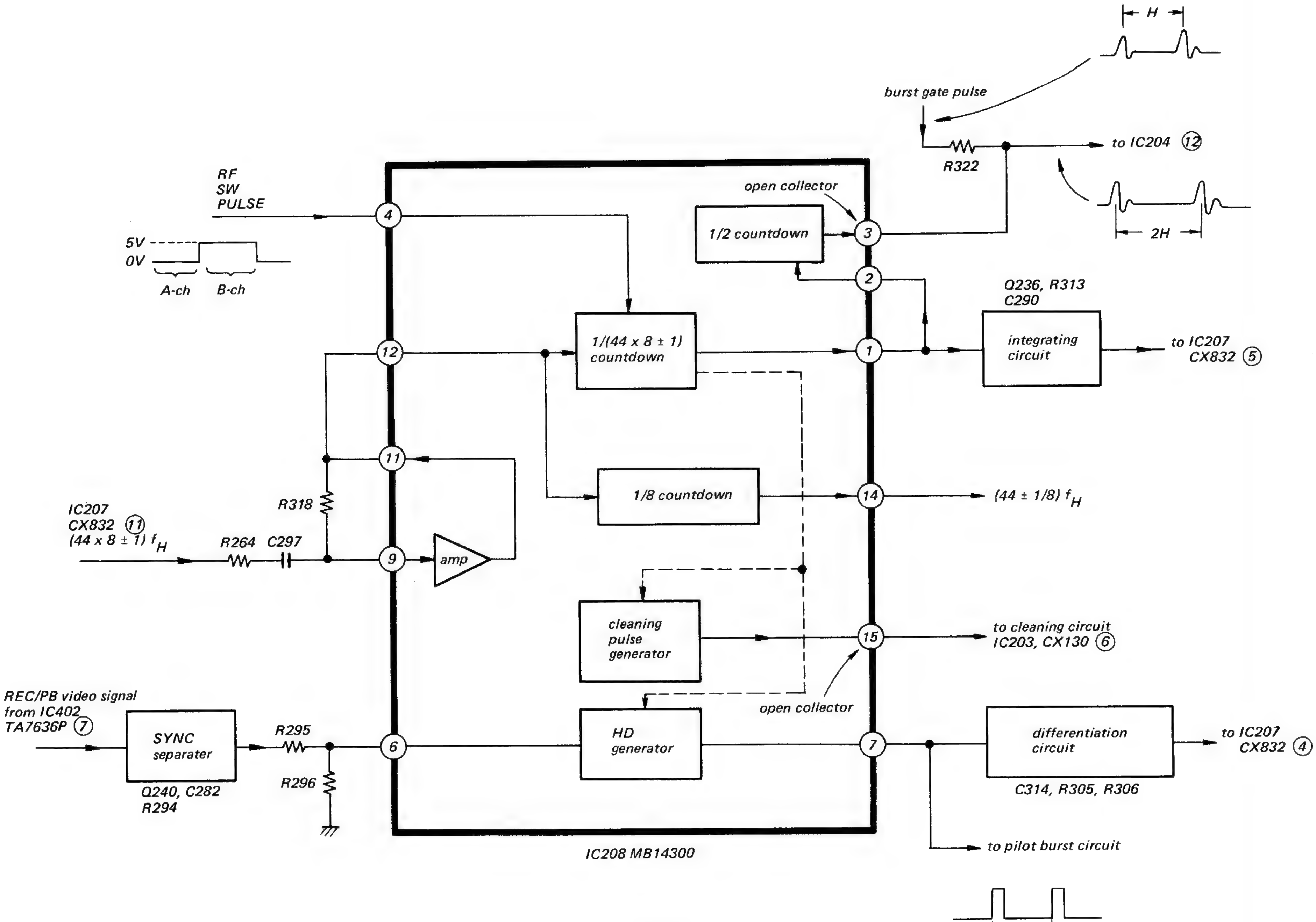


Fig. 3-30



H
burst gate pulse
R322
to IC204 (12)
2H
open collector
RF
SW
PULSE
5V
0V
A-ch
B-ch
1/2 countdown
Q236, R313
C290
1/(44 x 8 ± 1)
countdown
integrating
circuit
to IC207
CX832 (5)
1/8 countdown
(44 ± 1/8) f_H
IC207
CX832 (11)
(44 x 8 ± 1) f_H
R318
R264 C297
amp
cleaning
pulse
generator
to cleaning circuit
IC203, CX130 (6)
open collector
REC/PB video signal
from IC402
TA7636P (7)
SYNC
separater
R295
R296
Q240, C282
R294
HD
generator
differentiation
circuit
to IC207
CX832 (4)
C314, R305, R306
to pilot burst circuit
IC208 MB14300
H
4
3
2
12
1
11
14
9
15
6
7

Fig. 3-31

[Carrier Signal Phase Inversion and Bust ID Circuit] CX150B

IC205, CX150B, is arranged with the carrier signal phase inversion circuit and the burst ID circuit. Its block diagram is shown in Fig. 3-32.

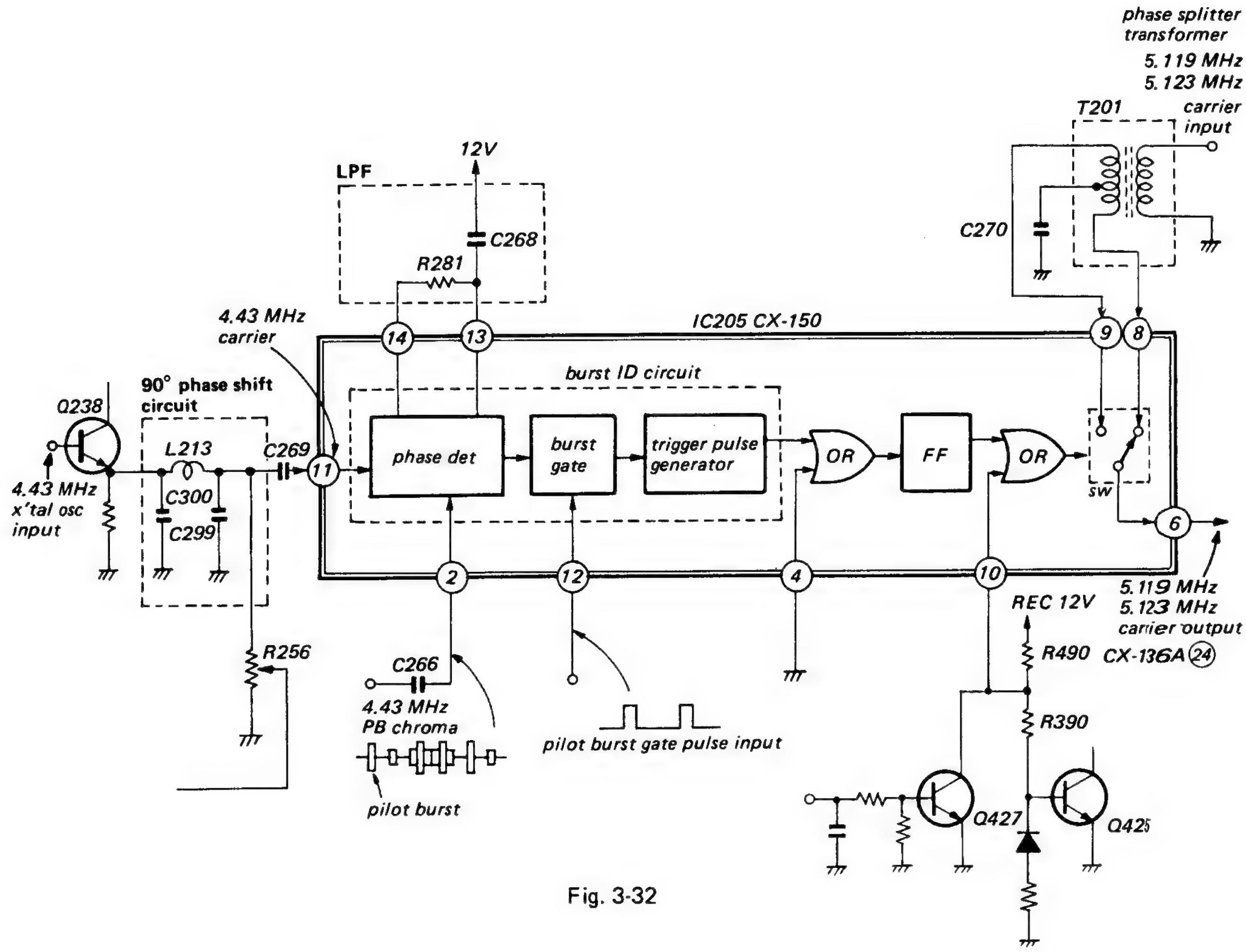


Fig. 3-32

The carrier phase inversion circuit is arranged with a flip-flop and a switching circuit. The 5.119 MHz or the 5.123 MHz carrier signal supplied from CX832 is phase-split in T201, phase splitting transformer. The phase split output from the secondary of T201 is supplied to the switching circuit via pins 8 and 9. The positive phase of the 5.119 ≒ 4.43 MHz + (44 - 1/8) fH or the 5.123 MHz ≑ 4.43 MHz + (44 + 1/8) fH carrier is applied to pin 8 and its negative phase to pin 9.

The output of this switching circuit (at pin 6) is supplied to the record and the playback chroma frequency conversion circuits. In the RECORD mode, the switching circuit is connected to the pin 8 side by setting pin 10 to the high level. In the PLAYBACK mode, the switching circuit is switched with the flip-flop output passed the OR gate. Sometimes the switching circuit operates reversely at a 50% probability, inverting the phase of the chroma signal when the trigger input of the flip-flop becomes disorder in the dropout section or depending on the ON-OFF states of the flip-flop when the PLAYBACK mode is set up. The burst ID circuit is for prevention of the reverse operation of the switching circuit. The burst ID circuit is an orientation circuit to supply the trigger pulse to the flip-flop when the switch phase becomes reverse and to restore the phase.

The orientation circuit compares the phase of the 4.43 MHz crystal oscillator output which is the reference signal in the PLAYBACK mode with that of the pilot burst signal of the 4.43 MHz chroma signal. A trigger pulse is obtained when the phase is inverted 180° and applied to the flip-flop via the OR circuit. Generally the relative phase difference between the pilot burst signal of the 4.43 MHz chroma signal and the reference 4.43 MHz crystal oscillator output is 90° when the APC is locked. Therefore the reference 4.43 MHz signal is fed through the 90° phase circuit to make the signal in phase with the pilot burst signal of the normal chroma signal before the phase comparison.

C and R circuit between pins 13 and 14 in the phase detector circuit is the filter for the detected output. The filtered output is applied to the burst gate which gates the burst period in the phase detector output. The trigger pulse producing circuit compares the internal reference voltage with the detected output voltage, detects a difference between the reference voltage and the detected output voltage in case of the 180° phase shift of the chroma signal, and produces the trigger pulse.

[1 H Delay Circuit]

IC204, CX150, functions for a chroma signal stabilization in the STILL mode. The fundamental operation of IC204 is arranged with a phase inverter circuit and a burst ID circuit as well as IC205, CX150.

The R-Y and the B-Y signals are repeated every line in the PAL chroma signal. The 1 H delay circuit detects a repetition disorder due to noises or others in the STILL mode and replaces the disorder with a 1 H delayed chroma signal to provide a stable color picture. The block diagram of the 1 H delay circuit is shown in Fig. 3-33.

The 4.43 MHz crystal oscillator output is supplied to pin 11 as the reference input for the phase detection. The 4.43 MHz chroma signal is supplied from pin 2 as the comparison input. Since the 4.43 MHz chroma signal is a repetition signal of the R-Y and the B-Y signals, a color continuity can be judged by gating the burst every other 2 H. See Fig. 3-34.

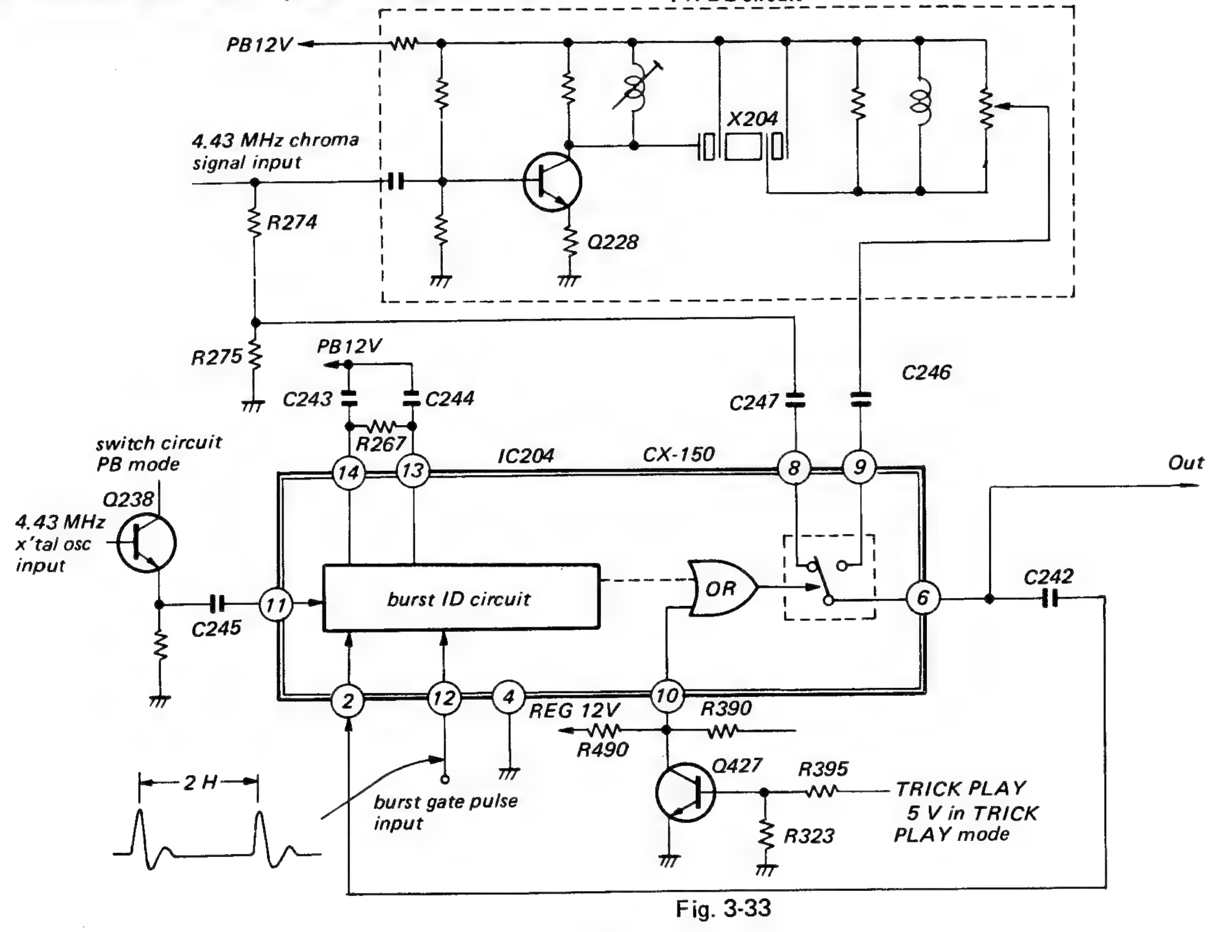


Fig. 3-33

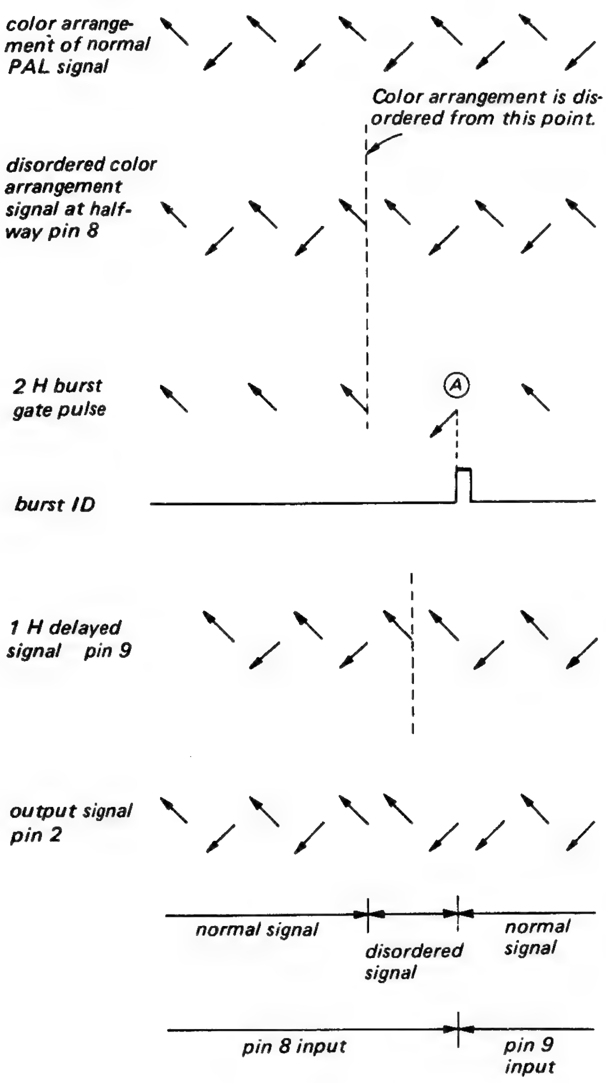


Fig. 3-34

When the chroma signal whose colour arrangement is placed into disorder at halfway is detected in the signal system, the phase of the 2 H burst gated burst signal is disordered largely at point A.
The burst ID pulse is produced when the disorder is detected. The burst ID pulse inverts the flip-flop, operating the switching circuit so that the input is switched to pin 9 from pin 8. Thus the 1 H delayed signal replaced with and the normal colour arrangement signal is restored.
Since in the trick mode, Q427 turns on, and pin 10 turns to 0 V, the switching circuit operates only in this condition. In other modes the switch is connected to the 8 pin side.

[ID Cleaning Circuit] CX130
IC203, CX130 is a switching integrated circuit. See Fig. 3-35.

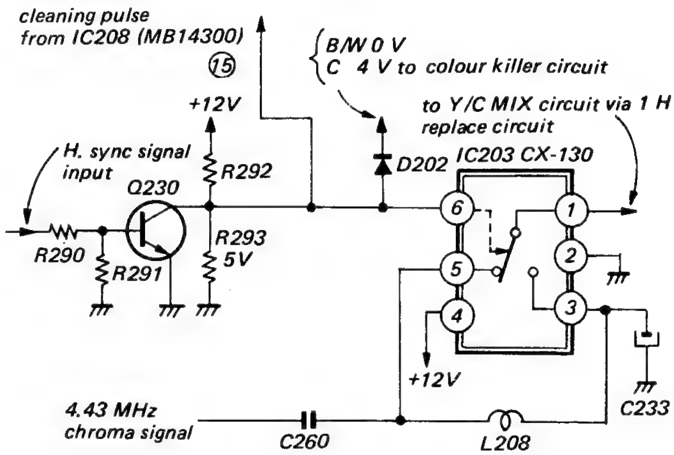


Fig. 3-35

The cleaning circuit functions for the cleaning of the sync signal segment which the pilot burst signal is inserted in and the one of the noises from the color circuit in the B/W mode.
L208 makes the DC potentials of the switching circuit, i.e., the inputs to pins 3 and 5, identical for prevention of switching noises. C233 is the capacitor for the input shorting.
The cleaning pulse phase is shown in Fig. 3-36.

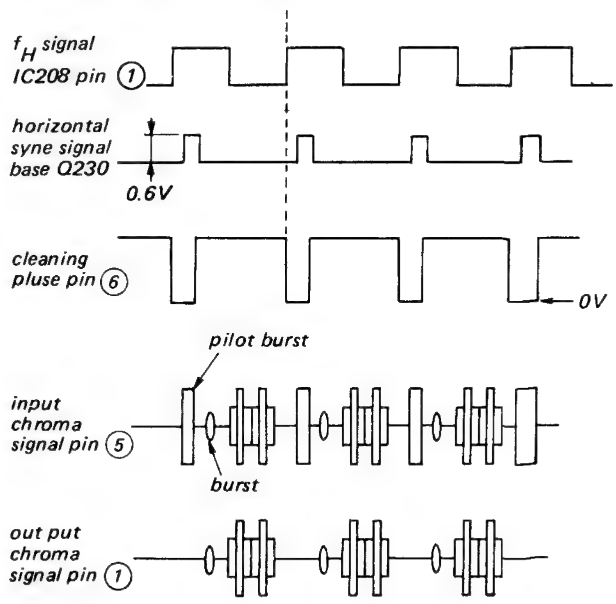


Fig. 3-36

Since the phase of the rectangular wave at pin 4 of IC208, CX145, is before the H. sync signal, the cleaning pulse produced in Q231 and Q230 starts in advance of the H. sync signal and performs the cleaning of the horizontal blanking segment with the pilot burst.

3-4 SERVO SYSTEM

General

This Servo circuit, consisting chiefly of an N-MOS IC (TM4217P), is contained in a half part of SERVO/LOGIC board. It includes the following circuits.

A disk servo circuit that governs the phases of the video heads and controls the head motor driving the reel tables, and a disk motor drive circuit.

A capstan servo circuit that keeps the tape at a specified speed and controls the tracing of the video heads in a correct phase relationship on the tape pattern in the play back mode of operation, and a capstan motor drive circuit.

A multi picture search circuit that controls the relative speed of the tape to the video heads to provide a capability of picture search at either of two speeds as high as approximately 8 times (normal search speed) the regular playback speed and approximately 20 times (high speed).

A double speed circuit that allows playback at a speed as high as two times the regular playback speed with the capstan circuit locked.

A vertical sync separator circuit, muting signal generator circuits, and others. Inside the servo IC, all the signal processes and generations are carried out in the digital fashion.

The head motor used, which is a brushless direct-drive motor, revolves the head and drives the reel tables.

The Capstan motor used is a DC motor having a set of brushes.

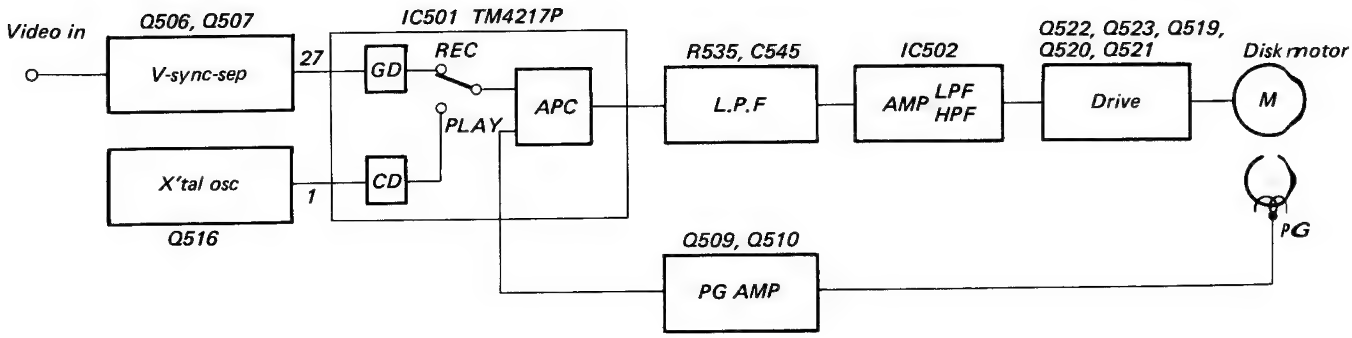
The functional circuits of the servo circuit are described in some detail in the following sections.

Video Disk Servo Circuit

Fig. 3-37 shows the phase relationship between the pair of video heads and 25PG coil, on the time chart. The operation of the video disk servo circuit is as follows.

The pair of the video heads are controlled in a fixed-phase servo control manner. That is, the DC, 3-phase, 8-pole Hall motor directly drives the video head assembly. Revolution of the video head assembly induces a pair of PG pulses that respond exactly to the movements of the video heads. In the recording mode of operation, the PG pulses are detected and compared in the phases with the vertical sync pulse separated from the recording video signal to keep the video heads at a constant speed, while in the playback mode of operation, the PG pulses are detected and compared with the reference trapezoidal wave composed of the clock pulse produced in IC501 to maintain the video head rpm at the constant speed.

The cylinder assembly consists of a fixed upper cylinder, a rotary video head assembly, a fixed lower cylinder. The rotary video head assembly has the pair of video heads A and B for normal PB and the pair of video heads B_1 and B_2 for trick PB and a couple of magnets placed on the video head disk, the pair and couple each being 180 degrees apart the other. The lower cylinder has the PG coil placed. The PG coil develops a couple of PG pulses whenever the couple of magnets passes over the PG coil. The developed PG pulses are used as the tack pulses for the video head servo control. The PG pulses, also are used to produce RF switching pulses for use of alternately switching over the video heads and for other purposes. Details of the video disk servo circuit will be described in the following sections.



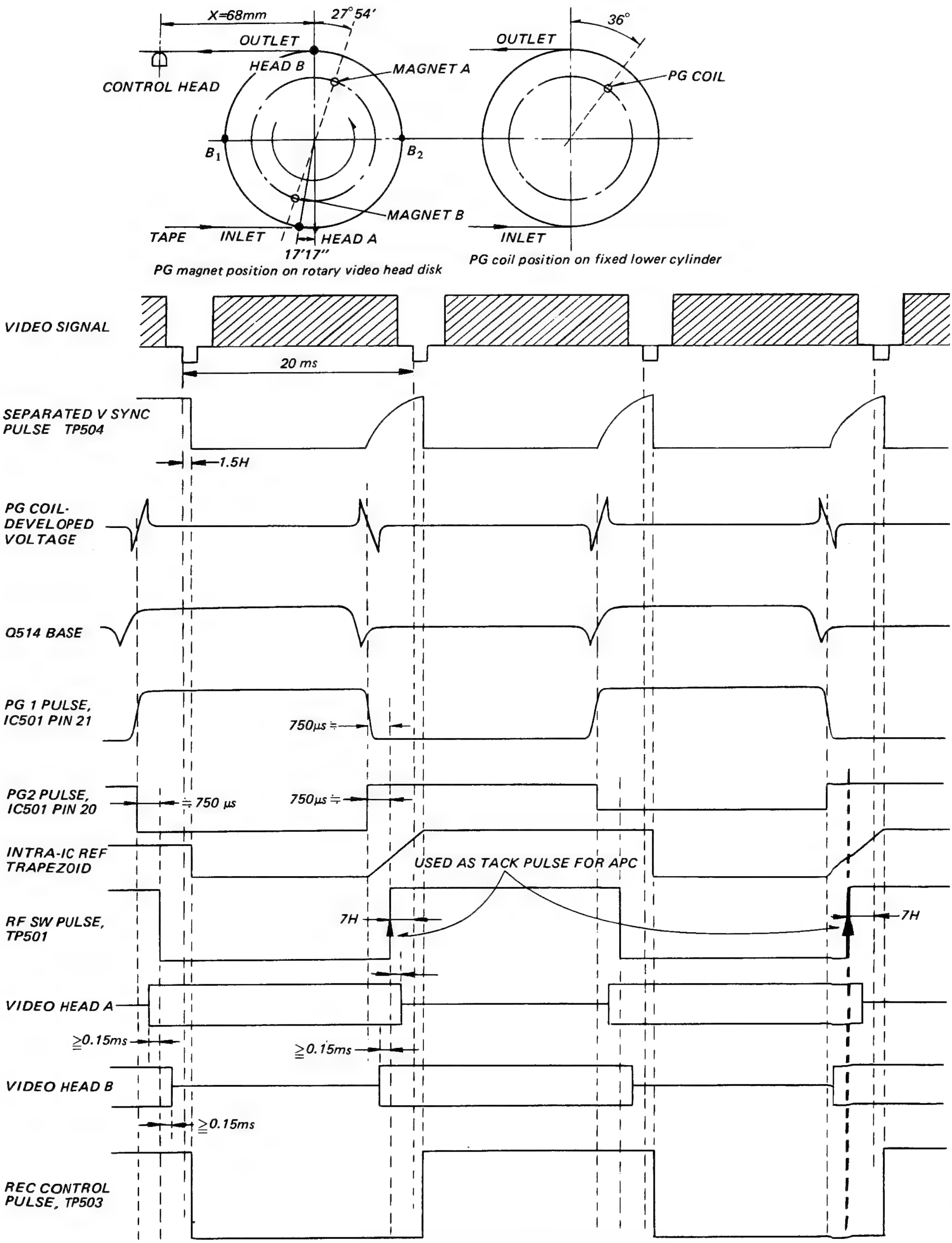
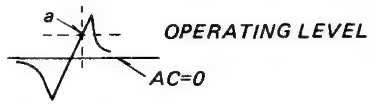


Fig. 3-37 Time CHart Illustrating Phase Relationships Between Video Heads and PG Magnets in Recording Mode of Operation

(1) PG Pulse Circuit

The couple of PG magnets and coil, which are positioned as illustrated in Fig. 3-37, develop PG pulses that exactly respond to the video head movement. The two PG magnets on the video head disk are different in the polarity. The voltage developed in the PG coil, by one PG magnet is opposite to the voltage by the other when the respective PG magnets come near and go away the PG coil. The PG pulse by one PG magnet is shown in Fig. 3-37 as observed across the PG coil on an oscilloscope. The actual PG pulse waveform has the upper part suppressed as one end of the PG coil is connected to the base of Q510. Fig. 3-38 is a PG pulse amplifier circuit.

When a voltage is applied to the disk motor. This starts the video head disk, which makes the PG coil develop the PG pulse. The PG pulse enters the PG pulse amplifier circuit successively. The connection of the R515 and R516 is present at around 0.4 V. If the first PG pulse having a waveform as

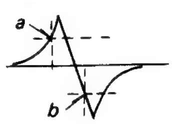


comes in, the descending edge of Q510 does not turn on Q510. When the base voltage of Q510 exceeds the operating level around point *a* of the ascending edge, Q510 is turned on. This, then, drops the base voltage of Q509 down to 0 V, the collector voltage rising up. The result is that the connection voltage of R515 and R516 becomes the value to which the line voltage is divided by a parallel of R515 and R518 plus R517 and R516. The resistor values are selected so that the connection voltage may be approximately 1.4 V, which keeps Q510 turned on.

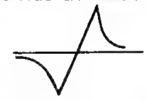
In turn, when the second PG pulse of opposite polarity having such a waveform as

comes in, the ascending edge does not change the state of Q510 which has been on. The descending edge drops the base voltage, or the above-mentioned 1.4 V voltage, of Q510 down to, the OFF level. This turns Q510 off, which allows current to flow through R520 and D503 into the base of Q509 to turn on. The connection voltage of R515 and R516 becomes the value to which the line voltage is divided by R515 and a parallel of R516 and R517. The resistor values are selected so that the connection voltage may be at the OFF level for the base of Q510. Thus, Q510 keeps turned off. The PG pulse amplifier repeats the on-off operation afterward; that is, it operates as the so-called Schmitt trigger.

If the first PG pulse having the waveform as comes in,

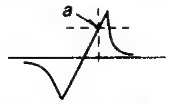


the ascending edge turns Q510 on at point *a*. The connection voltage of R515 and R516 becomes a value to which the line voltage is divided by a parallel of R515 and R517 plus R518 and R516. The subsequent descending edge drops at point *b* the base voltage of Q510 down to the OFF level for the base of Q510, which is turned off. This turns Q509 on and this keeps on until the succeeding PG pulse comes in. As the succeeding PG pulse has the waveform as

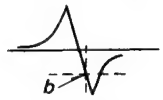


the ascending edge turns Q510 on, which turns Q509 off. These states are kept until the succeeding pulse comes in.

In short, Q510 is turned on by one PG pulse waveform as



at point *a* and it turns Q509 off irrrespective the polarity of the first PG pulse; and, Q510 is turned off by another PG pulse waveform as



At point *b* and it turns Q509 on.

The high collector levels of Q510 and Q509 determine the tracing periods of the heads A and B, respectively. The zener voltage of D503 deviates the Q509 off- and on-instants in reference to the Q510 on-. and off-instants to make the Q510 and Q509 connector crosspoint voltage for the PG 1 and PG 2 pulses input to IC501 higher than the threshold level of the IC, as shown in Fig. 3-39. If the crosspoint voltage is too low, this adversely affects the logic operation of the IC. The capacitor C513 bypasses possible radio-frequency noises induced in the PG coil by the magnetic flux of the video heads and the like. One of the two PG pulses is used as the detection pulse for a splicing recording.

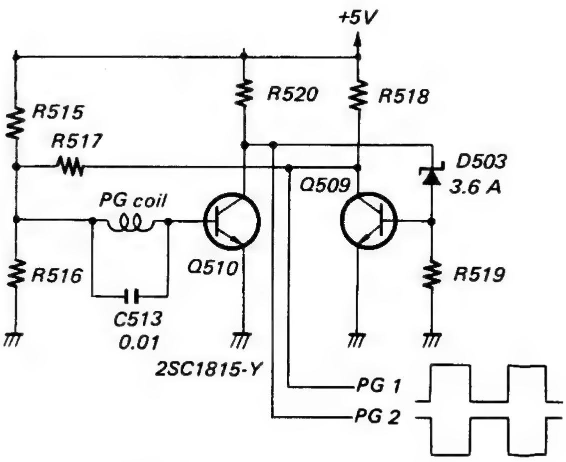


Fig. 3-38 PG pulse Amplifier Circuit

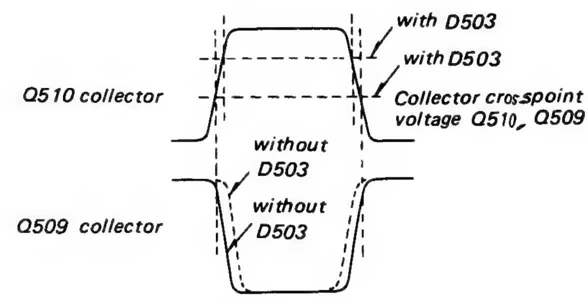


Fig. 3-39 Effect of D503

(2) PG Pulse Delay, Phase Detector, and RF Switching Pulse Generator Circuits

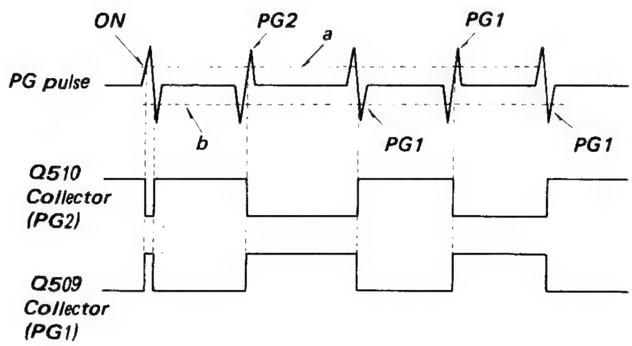
These circuits are contained in IC501 (TM4217P). The PG 1 and PG 2 pulses input to pins 20 and 21 on IC501 are delayed approximately 750 μsec at their respective trailing edges through the internal mono-stable multi-vibrators and time constant circuitries of R551 and C514 and R552 and C515. Note that the delay time is to be adjusted in playback with use of a master tape so that the leading edge of the RF switching pulse may be 7 Hs behind the playback vertical sync pulse VD. With the delay of the PG pulses, a RF switching pulse is formed which rises up at the time of the delayed leading edge of the PG 1 pulse at pin 21 and drops down at the time of the delayed trailing edge of the PG 2 pulse at pin 20. The leading edge of the RF switching pulse is used as the tack pulse for the video head APC action either in the recording or playback mode of operation. The leading and trailing edges, also, are used for switching the video heads A and B, for detecting the head revolution, and others. The RF switching pulse is fed from pin 15 on the IC through the buffer transistor Q511 to the respective circuits.

In the recording mode of operation, the phase comparator circuit compares the leading edge of the switching pulse with the phase of the vertical sync pulse separated from the recording video signal. In the playback mode of operation, it compares the leading edge with the phase of the reference trapezoidal wave formed of the reference clock delivered from the Video Circuit. The signal resulting from the phase comparison is processed in a digital fashion. The timing relationship on the slope of the trapezoidal wave is shown in Fig. 3-40.

There is in the IC an additional speed detector which detects the period of the switching pulse. The speed detector makes the phase comparator produce a low level output, a high level output, or a trapezoidal wave according as the switching pulse frequency is out of, within, or at 25 Hz ±1.7%. In the steady state, therefore, the leading edge of the switching pulse is always locked on the slope of the trapezoidal wave. The 1.5 kHz duty modulation output corresponding to the position on the slope is held until the leading edge of the next switching pulse comes in. In the duration, the output voltage is integrated and applied to the positive end of the operational amplifier in IC502. The negative end has the sum of the voltage divided by R585 and R586 and the voltage fed back from the disk motor. The integrated voltage at pin 13 balances at the phase locked on the trapezoidal wave at any time so as to be equal to the sum of the voltages.

Therefore, in the recording mode of operation, the phase of the switching pulse leading edge is determined in terms of the voltage at the negative and of the operational amplifier (IC502, pin 6) as referenced to the recording vertical sync pulse. This means only that the phases of the video head B and the vertical sync pulse are relatively determined.

But, the vertical sync pulse cannot be determined yet as to where it is recorded on the tape. As for the phase of the video head A which is not servo-controlled, also, it is still not specified. The switching pulse and the video heads A and B are adjusted is the phases by playing back the master tape on which the vertical sync pulse is recorded in the connect position. The switching pulse leading edge is locked at the same position on the slope of the trapezoidal wave formed in the same time relationship both in the recording and playback time in which the PG pulse is converted to the switching pulse is varied to adjust the phase of the playback vertical sync pulse of each video head A or B in reference to the switching pulse. This allows the vertical sync pulse to be also recorded at the same position as the master tape. The noise due to head switching in playback, also, can be hidden out of the effective picture area on the bottom of the screen.



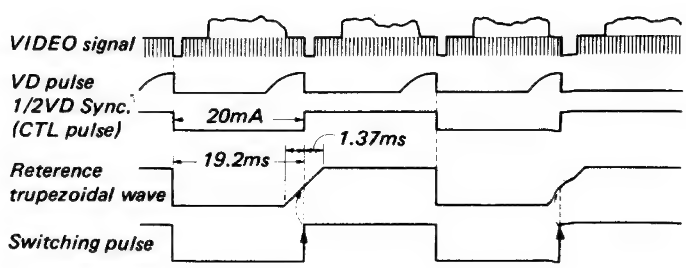


Fig. 3-40 Relationship of VD signal

(3) Disk Servo System Phase Compensation and Disk Motor Drive Circuits

The disk servo system likely oscillates unless a phase comparison is provided since it has the phase detection loop only. It, also, needs to have a low-pass filter which smooths the detected output of the 1.5 kHz duty modulation to eliminate the carrier component.

The disk servo system is made stable by R538, C525, R597, and C544 and has R535, C524, and C545 to eliminate the carrier component. The detected voltage is smoothed and applied to pin 5 on IC502. The smoothed voltage is compared with the reference voltage at pin 6. The difference voltage is fed out from pin 7 to the negative feedback amplifier, consisting of Q519 through Q523, which amplifies it. The emitter voltage of Q522 controls the current flowing through the winding of the disk motor so that the revolutional phase of the pair of video heads assembled together with the disk motor should coincide with the reference phase.

The base of Q515, connected to pin 11 on IC501, is set to the low voltage when the switching pulse frequency is out of 25 Hz ±1.7%. It is set to the high voltage when the frequency is within the range. Such level changes adjust the current charged into and discharged from C525 which takes the longest time for charging and discharging. This is needed to shortens the starting and speed reducing times of the disk motor.

In any mode of operation except picture search, Q514 is open, D505 is reverse-viased, Q526 is on, and Q527 is on. In picture search, they are in the opposite states.

The disk motor is stopped by Q524 in the way that the disk motor stop signal output of the Logic Circuit, when becoming high, turns Q524 on. In stopping, the voltage at pin 9 on IC501 is set to the low level. This makes high the capstan phase detection voltage at pin 7 on IC501, the capstan speed detection output at pin 8, and the disk motor phase detection output. These level changes charge their respective output capacitors. The charged capacitors assure that the motor control voltage can be securely applied to the disk motor to revolve when the disk motor stop signal becomes low. The diodes D529 and D542 are placed to disconnect pin 9 on IC501 from the disk motor operational amplifier output voltage while Q517 is off, or the disk motor is revolving.

Fast-forward (FF) or rewinding (REW) of the disk motor is set by D519 and R594. The connection of them is open either in the fast-forward or rewinding mode of operation only. It is at the low level in any other mode. The divided voltage at the connection of R594 and R587 is applied to the base of Q519 which saturates the output transistor Q520. The voltage level at one end of R587, or at pin 7 on IC502 is held low as the low level at pin 13 on IC501 is due to the disk motor revolutional frequency of approximately 4,000 rpm. The disk motor, then, revolves the reels at a high speed through the belt and planetary gears. One of the reels winds or rewinds the tape.

The disk motor may cause some wow and flutter every turn of revolution cannot be reduced by any circuit technique as only one phase comparison PG pulse can be detected during the turn of revolution. The wow and flutter may appear as jitter on the screen unless the HD pulse intervals either in the recording or playback mode of operation should be identical. For obtaining the identical HD pulse intervals, the disk motor used is designed so as to minimize the wow and flutter as well as its moment of inertia is made large.

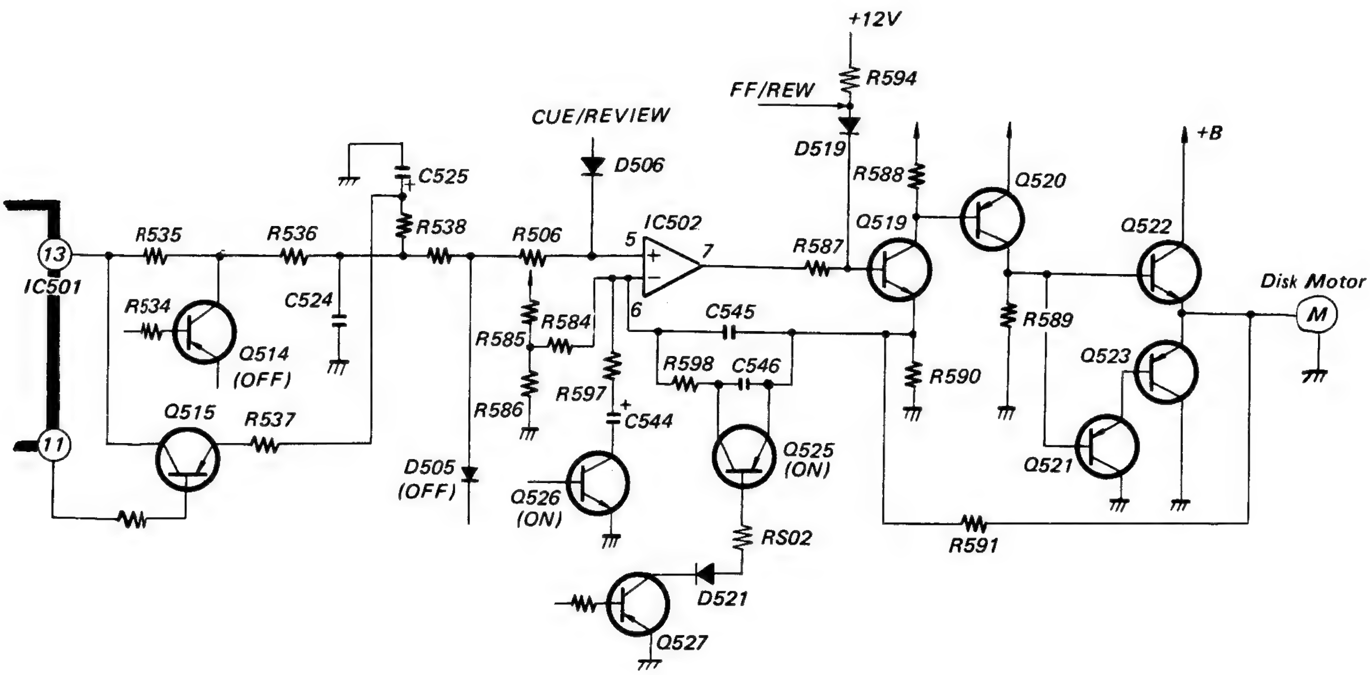


Fig. 3-41 Disk Servo System Phase Compensation and Disk Motor Drive Circuits

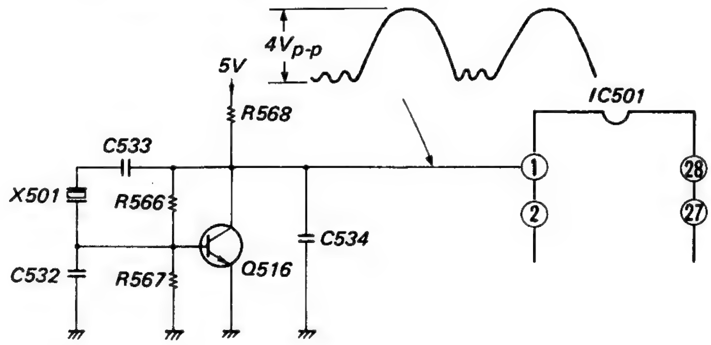
(4) Recording Vertical Sync Separator and Internal Reference Signal Oscillator Circuits

In recording, an additional vertical sync pulse separated from the video signal is used. This was illustrated in the time chart in Fig. 3-37. The vertical sync pulse separator is provided specifically for the video head servo-operation to extract the vertical sync pulse only. The video signal is fed from the emitter of the final transistor stage in the Video Circuit, having an amplitude of 2 Vp-p as measured from its top. The first transistor stage Q506 in Fig. 3-42 extracts both horizontal and vertical sync pulses. The integrating network consisting of R503, C503, R504, and C504, further, extracts only the vertical sync pulse, which is supplied to the monostable multivibrator. This monostable multivibrator rejects the noise components on the V-sync signal to prevent the malfunction of IC.

(5) Crystal Oscillator Circuit

All the timing operations are based on, or referenced to the output of 2.986MHz crystal oscillator circuit. IC501 uses a 746 KHz clock which is divided from the 2.986 MHz reference signal (2.986 MHz/4 = 746 KHz). The crystal oscillator circuit consisting of Q516, C532, C534 and others outputs a 2.986 MHz sine waveform which has a 4V level to pin 1 of IC501.

In the playback mode of operation, all the servo operations are referenced to the clock.



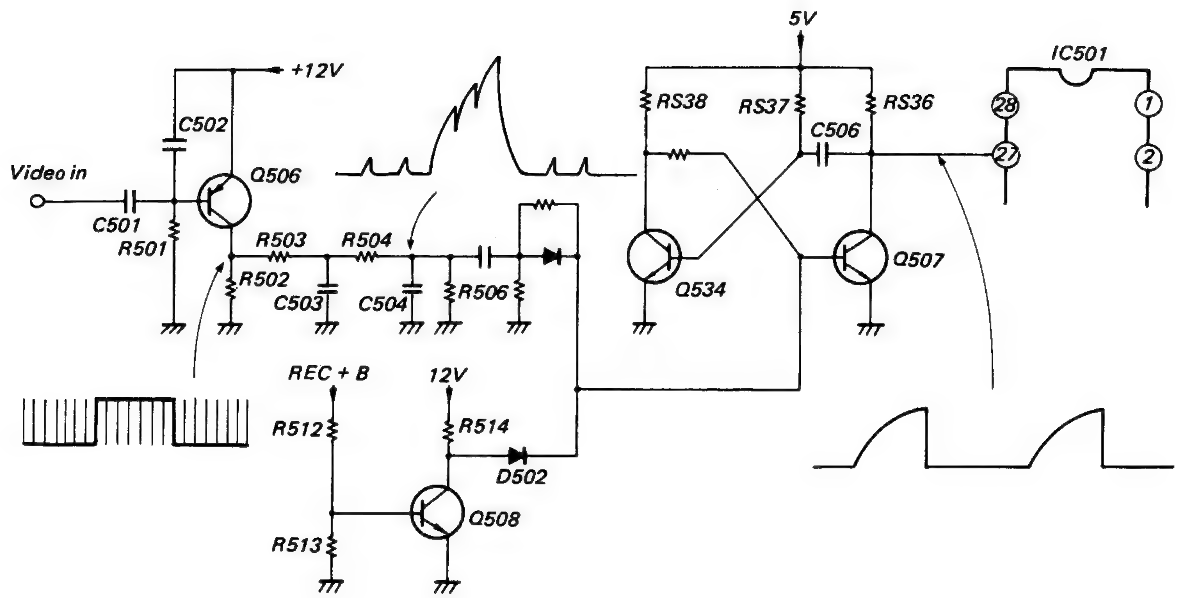


Fig. 3-42 Vertical Sync Pulse Separator Circuit

Capstan Servo Circuit

The capstan is driven by the capstan motor through the belt and pulley. In the recording mode of operation, the capstan servo circuit controls feeding the tape at a specified speed; in the playback mode of operation, it picks up the pulse put on the control track in recording to servo keeping the phase relationship between the video head revolution and the picked-up pulse as the tracking servo circuit. In the present capstan servo system, the capstan motor has a FG put on and also the capstan flywheel has another FG. The pulse developed from the flywheel is frequency-divided for use as the tack pulse for the APC in recording as the case with the control pulse in playback. Such a use of the FG pulses is advantageous in that in recording, the capstan needs not to precisely adjust the belt, pulley, and any other mechanical device, but the FG pulses are always at the frequencies determined in a digital way in IC501. The determined capstan flywheel FG pulse frequency is 100 pulses per revolution. The revolutional frequencies and frequency divisions of the capstan flywheel and capstan motor are shown in Fig. 3-43.

The capstan servo system makes use of a double control loop, consisting of an APC and AFC loops, as the capstan motor revolutional frequency is switched to change the tape speed and a rather higher system stability can be obtained. The sum of the two loop error voltages is used to drive the capstan motor. Details of the capstan servo circuit will be described in the following sections.

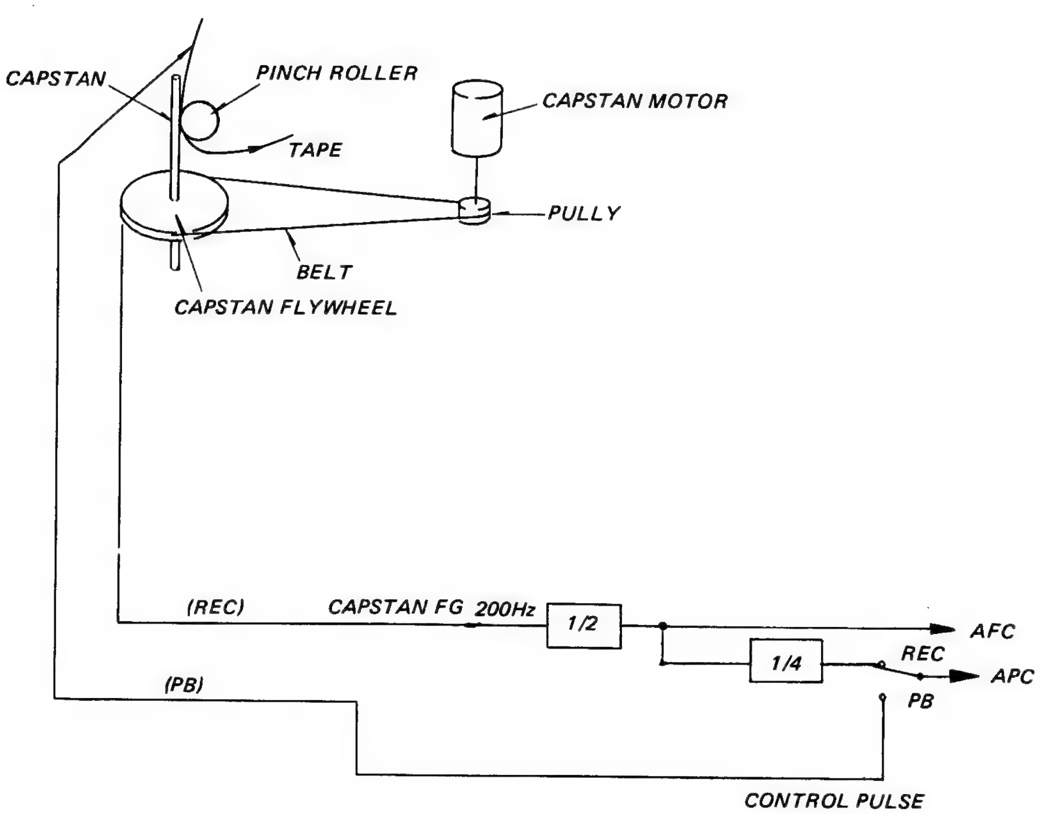


Fig. 3-43 Captan Motor Drive Circuit with Frequency Dividers

(1) CTL Recording Pulse Circuit

The CTL recording pulse circuit is the circuit to record CTL pulses in the control track as a comparison to ensure that the video head follows the video track accurately during playback. To provide an initial trial feed, approximately 200mm of the initial portion not used for servo is fed at the start of recording.

When an input of the synchronous separated vertical synchronizing signal is received at Pin 27 during recording, a 1/2 demultiplied recording CTL pulse signal appears at Pin 26. In regular sets this signal is amplified with a transistor (for saturated recording) and supplied to the CTL head. As this set possesses trial feed functions, the CTL pulse circuit is provided with a duty modulation circuit. The 1/2 vertical synchronizing signal output from Pin 26 of IC501 is differentiated by C512 and RS33 and is fed to the mono multi formed by Q503 and Q533. This mono multi operates according to the time constant of RS29 and C552 at the starting portion of recording (for approx. 12 seconds after pushing the recording button). This is due to the fact that, as C511 is discharged to ground potential by D534, recording 12V cannot be carried out prior to recording such as when in stopped condition and as Q532 is on at this time RS31 will be in shorted condition. Now, if the recording button is pushed and the set is in recording condition, recording 12V will be added, D534 will go off and 1/2 vertical synchronizing signals will enter the mono multi. Immediately after pushing the button, the voltage on C511 will be near zero, Q532 will be on and the set will operate by the time constant of approximately 10m sec determined by RS29 and C5522. When the voltage on C511 increases as it is charged by the base current of RS26 and Q532, Q532 will move in the off direction and will go off approximately 12 seconds later (approx. 200mm when the tape is traveling). As this time constant is longer than 20m sec, Q533 will be driven off by the falling portion of the 1/2 vertical signal and a voltage equal to that on Pin 26 of IC501 will be supplied to the CTL head. Condition A of the timer chart in Figure 3-45 is the starting portion of recording and B is the normal condition.

When the CTL current flows from the positive to the negative terminal, it flows from recording 12V, voltage divider RS23, D532 and RS24 and to the CTL head RS34 and Q503. When in reverse condition it flows from RS25, RS34, CTL head and RS24 and approx. 1mA of current flows in either case.

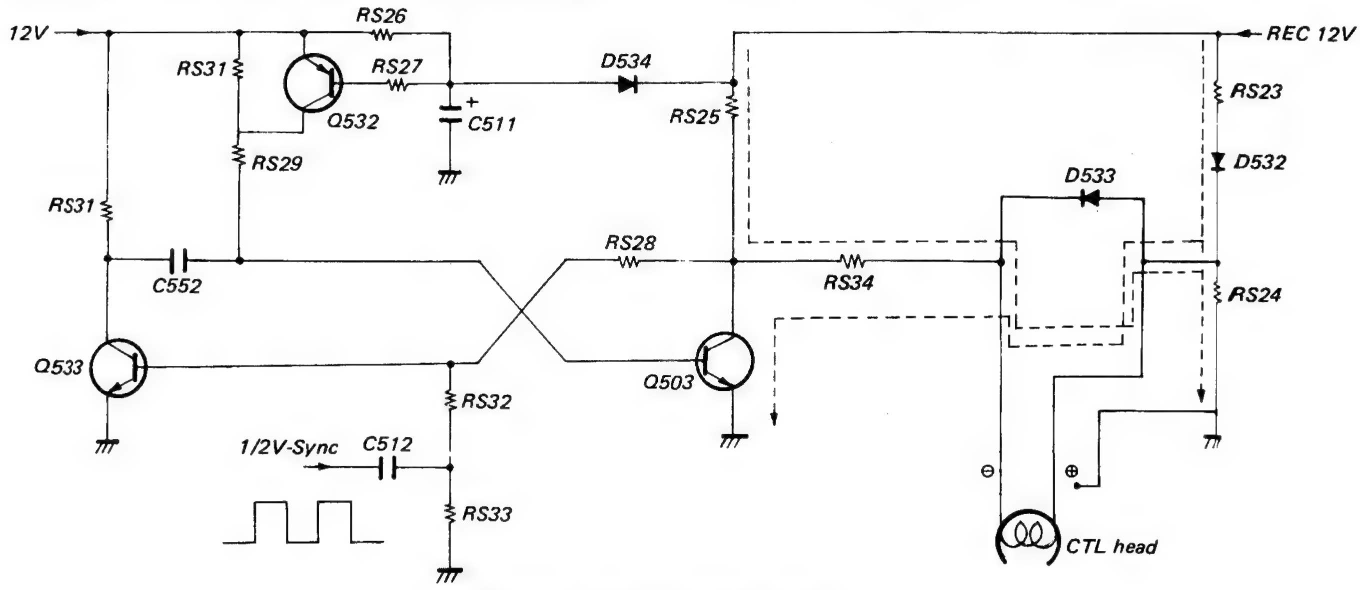


Fig. 3-44 REC CTL Pulse Circuit

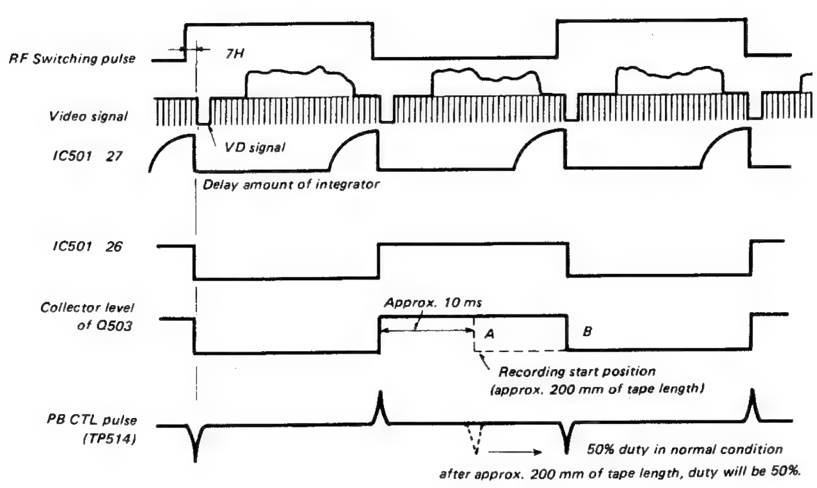


Fig. 3-45 CTL Pulse Timing CHart

(2) Playback CTL Pulse Circuit

During playback, the CTL pulses recorded on the tape are retrieved and capstan servo is applied. As the signals to be played back by the CTL head are extremely small (only 1.5 to 2mVpp), it will be necessary that the amplifier will also be highly sensitive to noise. When the CTL signal enters Pin 2 of IC504, it will increase to 1 Vpp with an amplification of approx. 50dB. The signal is next formed into square waves in the Schmid trigger circuit using an OP amplifier and this is supplied to Pin 24 of the servo IC, IC501.

R511 is the gain adjustment resistor and C509 acts to remove noise from the high frequency elements. As 0.1V is selected as the operating level of the Schmid trigger, playback is possible even when the CTL pulses are small such as in soft tapes or old tapes.

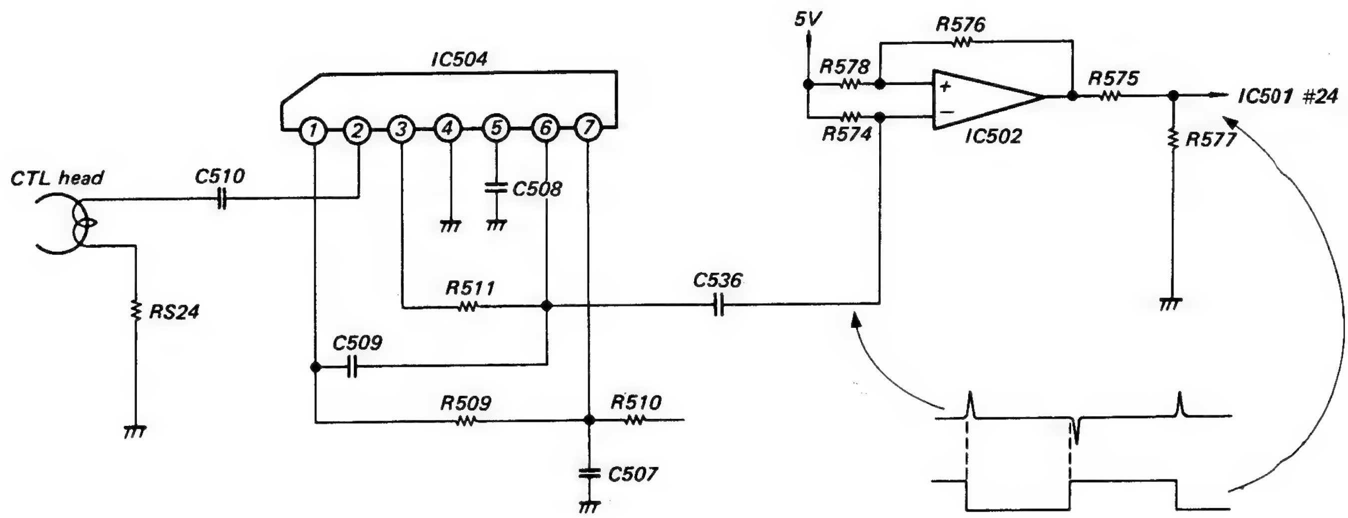


Fig. 3-46 PB CTL Pulse Amplifier Circuit

(3) Capstan FG Amplifier Circuit

The capstan FG rotates the capstan at a constant speed and generates 100 pulses per revolution of an FG gear mounted on the capstan flywheel to feed the tape at its stipulated speed. The capstan rotates 2 times per second and records at a frequency of 200Hz. The output during record or playback is sine wave of approximately 20m Vpp. If the capstan rotates faster the output increases and vice versa. As shown in Figure 47, the circuit is a Schmid circuit composed of a transistor amplifier and an OP amplifier.

The capstan FG has an important role as an AFC input signal to turn the capstan motor. In the still slow mode, still slow images are obtained by stopping the capstan motor and preventing the tape from travelling. Although rotation signals (H level) are emitted as servo outputs at this time, as the motor is stopped by the output circuit, when the still slow mode is released, the motor should turn. If these FG circuits are defective, the servo IC will malfunction when still-slow mode is released and the motor will not turn. Here Q517 is used to amplify to approximately 600mVpp and this is formed into square waves with the Schmid trigger circuit of IC501.

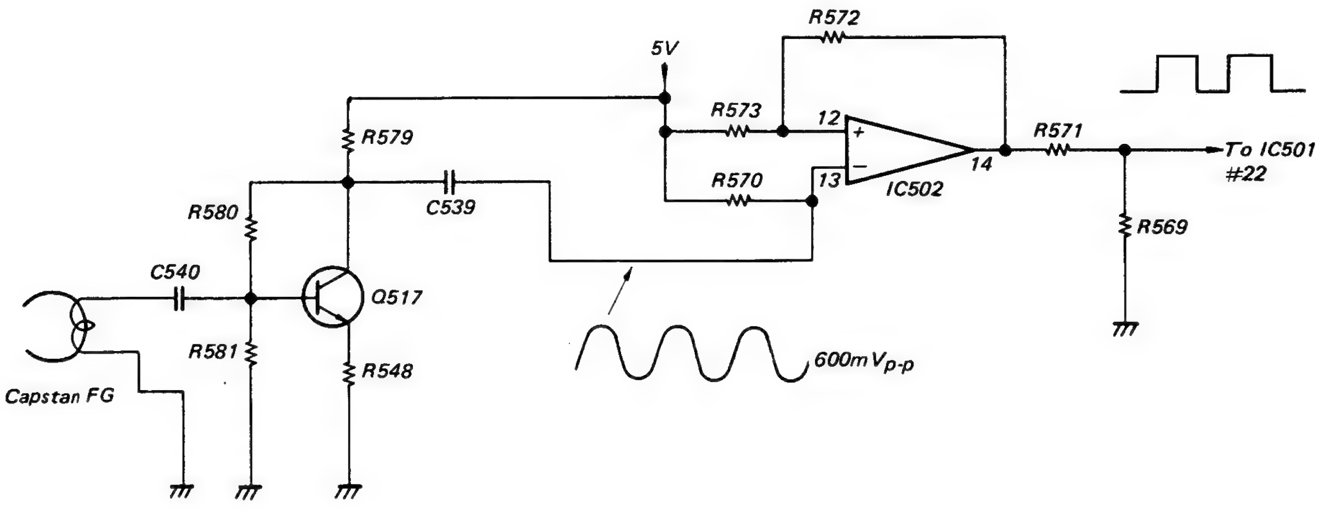


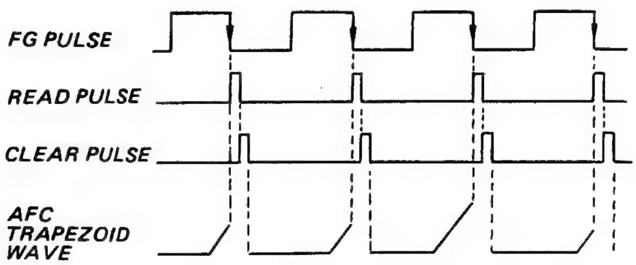
Fig. 3-47 Capstan FG Amplifier Circuit

(4) Speed Detection, Phase Comparison and Record/Playback Switching Circuit

Speed detection, phase comparison and record/playback circuits are all incorporated in IC501 and these functions are all processed digitally.

Speed detection is carried out by measuring the time interval of the falling FG input pulse. That is, read-out pulses are created by the falling FG pulse and clear pulses to clear the counter to start anew are created by these read-out pulses. Read-out pulses and clear pulses are generated again in the same manner during the next fall of the FG pulse. However, the position of the read-out pulse in the trapezoidal wave is memorized and duty pulses corresponding to this voltage are generated and are output at Pin 8 as AFC detection voltage.

AFC sampling is carried out at 100Hz and duty pulses of 1.5 kHz are emitted by memorizing the previous condition until the next sampling voltage is received. An upper limit and lower limit detection circuit is also provided which outputs high and low signals when other than ±6.8% in relation to 100Hz.



(5) Phase Compensation Circuit

APC and AFC detection outputs are obtained at Pin 7 and Pin 8 of IC501 and, after passing through the carrier removal and phase compensation filter, are compared to the output of Pin 9 of IC502. The voltage differene is amplified and supplied to the capstan motor drive circuit. The capstan motor drive circuit is provided in Servo II board which carries out cleane slow operation. APC filtering is carried out by R543, R545 and C528 and this is added to the AFC voltage by R546. R561, C530, RS15, and C538 form a phase compensation filter which is therefore concerned with both AFC and APC. During recording, the APC uses a 1/4 demultiplied capstan FG and, during playback, it uses the CTL signal. This change over is carried out by impressing a voltage (add 12V to recording) to Pin 23 of IC501. A 1/4 demultiplied (FG) input is used for Pin 23. If voltage is not applied, a switching servo will be applied to the CTL signal on Pin 24.

AFC retrieves FG signals by means of the FG gear mounted on the capstan and the gear and coil mounted on the capstan sleeve side, and this AFC circuit functions to rotate the capstan 2 times per second. In the double speed mode, the circuit operates at twice the speed by 1/2 demultiplication of the FG signal and the CTL signal.

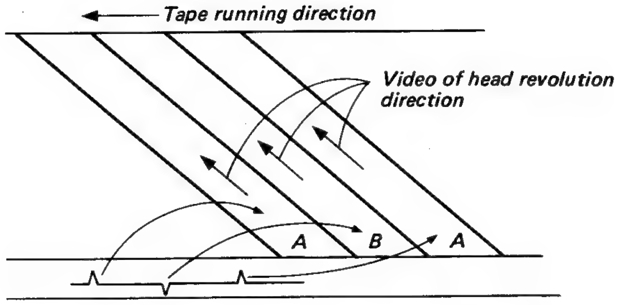
Similar to the head motor, Q524 goes on when the unit is stopped and the AFC, APC output is driven to low level on the input side of IC502 by D511. All functions in the still-slow mode are carried out in the servo II board and Q518 goes on to speed initial rise during release while the voltage on C528 and C530 is made the same as during servo lock. The voltage on both ends of C538 is made as low as possible as it takes time for C538 to return to normal when the change in voltage is great in D513 and D514 during special playback periods.

(6) Tracking Circuit

To ensure that the head traces the recorded tape track accurately during playback, the head tracing position is determined by initially recording a CTL signal as a guide. Although the CTL head position adjustment is carried out with a master tape determined by the respective sets, a tracking circuit is provided from the viewpoint of correcting head center position during recording and playback due to errors and overlapped recording.

Although both head APC and capstan APC both use standard signals counted down during playback rather than quartz oscillations, the capstan APC circuit alone is provided with a variable delay circuit and is set up for optimum operation with its head tracing position movable in relation to CTL pulses. As shown in Figure 3-48, the video track is also recorded in relation to the CTL pulses during recording. As head width is 37μm in relation to a track pitch of 32.8μm, a 4.2μm overlapped write-in will be carried out during recording. If track width head width and level are accurately produced, they may be considered the same as track pitch. If the head center is shifted 2.1μm during playback, it will be advantageous in relation to fluctuations of the envelope. Although it will be approximately 1.2m sec if converted to time, in the present state the tracking center is experimentally matched shifted 1m sec. Although tracking relations are as shown in Figure 3-49, the standard count down by means of the quartz oscillator delays the capstan APC only. The aforementioned 1m sec. is matched to the center click point of the tracking VR with R553. The tracking VR has a variable range of approximately ±9m sec.

When the tracking VR is moved, the reference point of the capstan phase comparison trapezoidal wave will change and the playback CTL pulse will be phase locked to this. The head (switching pulse) phase relation will therefore be maintained and servo will be applied. It will therefore be possible to vary the head tracing position and produce the optimum envelope in relation to the CTL pulse by varying the tracking VR.



Relationship between Control Pulses and Video Tracks

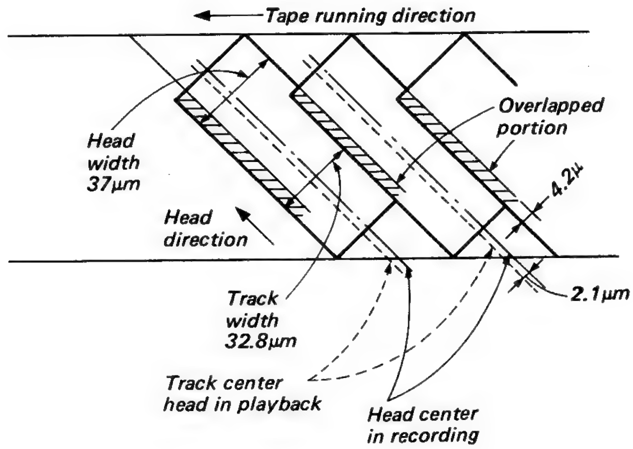


Fig. 3-48 Video Head Positions in Recording and Playback

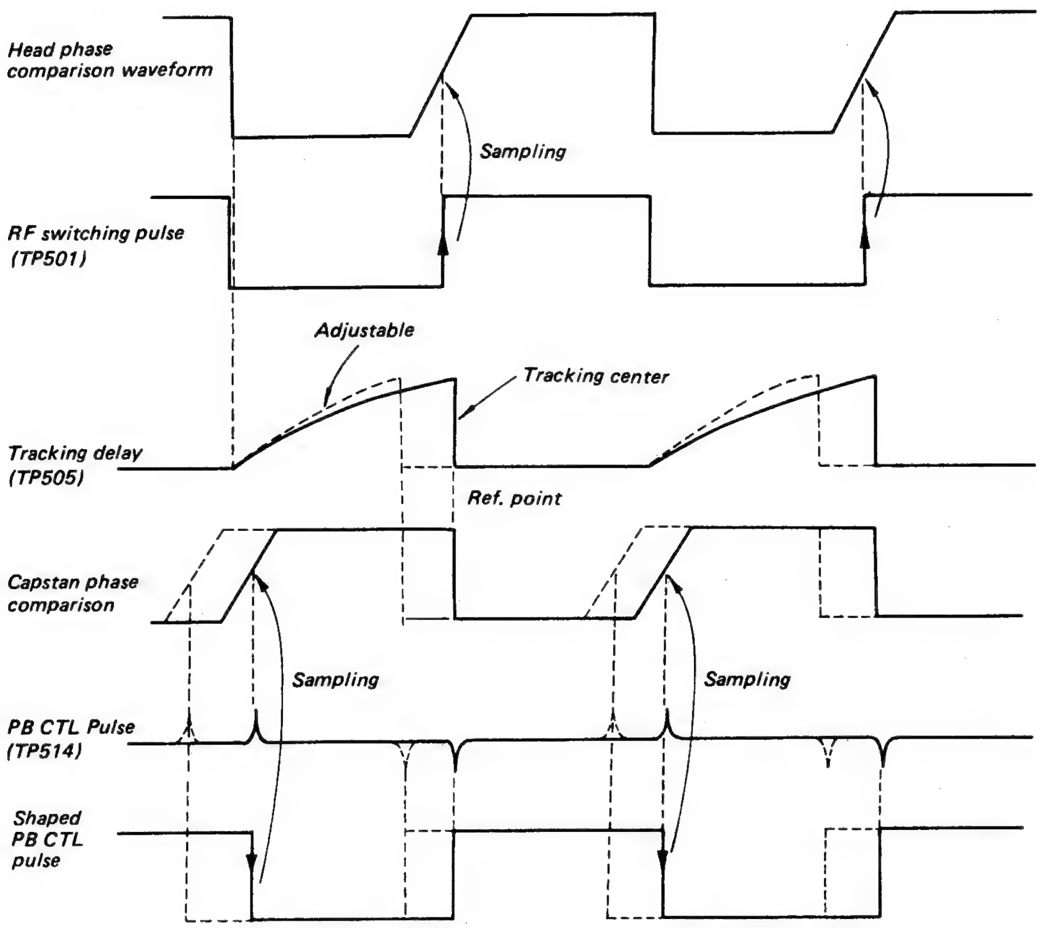


Fig. 3-49 Playback APC Time Chart

(7) Other Circuits

Muting Trick Play Signal Oscillation Circuit

In the video muting operation, Pin 5 of IC501 (detected CTL pulse signal frequencies which is at low level when the frequency is low) and Pin 12 of IC501 (disk servo unlocking signal) are detected and high level signals are sent to the video circuit for video muting during playback of the end of the recorded tape and during disk servo unlocking operations (during pulse rise). In audio muting, the video muting and special playback signal OR are supplied to the audio circuit. Although Pin 5 is at low level during the still-slow mode, muting is forcefully removed by means of D529 and RS09.

Multi Picture Search Circuit

Tape travel speed is high during the picture search mode as the reel is driven by the Head motor and the pinch roller pressure is released. As the tape speed during picture search is greatly different to that during playback, the relative speed of the tape and head will differ. The number of H's in a 1V period (1 field) will also increase during review and decrease during cue. See Fig. 3-51. The relative speed will also vary according to the diameter of the tape reel. During playback, speed may be varied from 4 to 8 times during the normal picture search and 12 to 25 times for super picture search. When the number of H's in a 1V period increases or decreases, the horizontal frequencies also increases or decreases. This will differ according to the playback speed and variatiions will be a maximum of 10% during review and −10% during cue. Proper images cannot be reproduced when this occurs as horizontal synchronizing will become erratic. For this reason, the feedback circuit is provided to make automatic corrections so that reproduction is always carried out at a horizontall frequency of 15.625kHz. This is accomplished by detecting the reproduced horizontal sync signal (fH) and raising the head speed if the frequency is below 15.625kHz and reducing the head speed if the frequency is above 15.625kHz. Although this will correct the horizontal frequency and eliminate colour drift by dringing the frequency within the range of the horizontal sync., the vertical frequency will shift from 25Hz as head speed will be corrected. This is unavoidable and the discrepancy will become greater as the picture search speed becomes higher and will reach a maximum of ± 10% as in the case of the horizontal frequency prior to correction. As the vertical syncronizing range in TV sets are normally fairly wide, picture rolling may be eliminated by adjusting the vertical sync. VR. During review, the picture will shrink as the vertical frequency will increase and during cue, the picture will expand when the frequency decreases. To reduce noise width, picture search is also carried out by means of subheads B_1 and B_2. In this manner, the head changeover RF switching pulse is corrected by means of the monostable multivibrator and the picture position will shift slightly up or down without any change in the delay time.

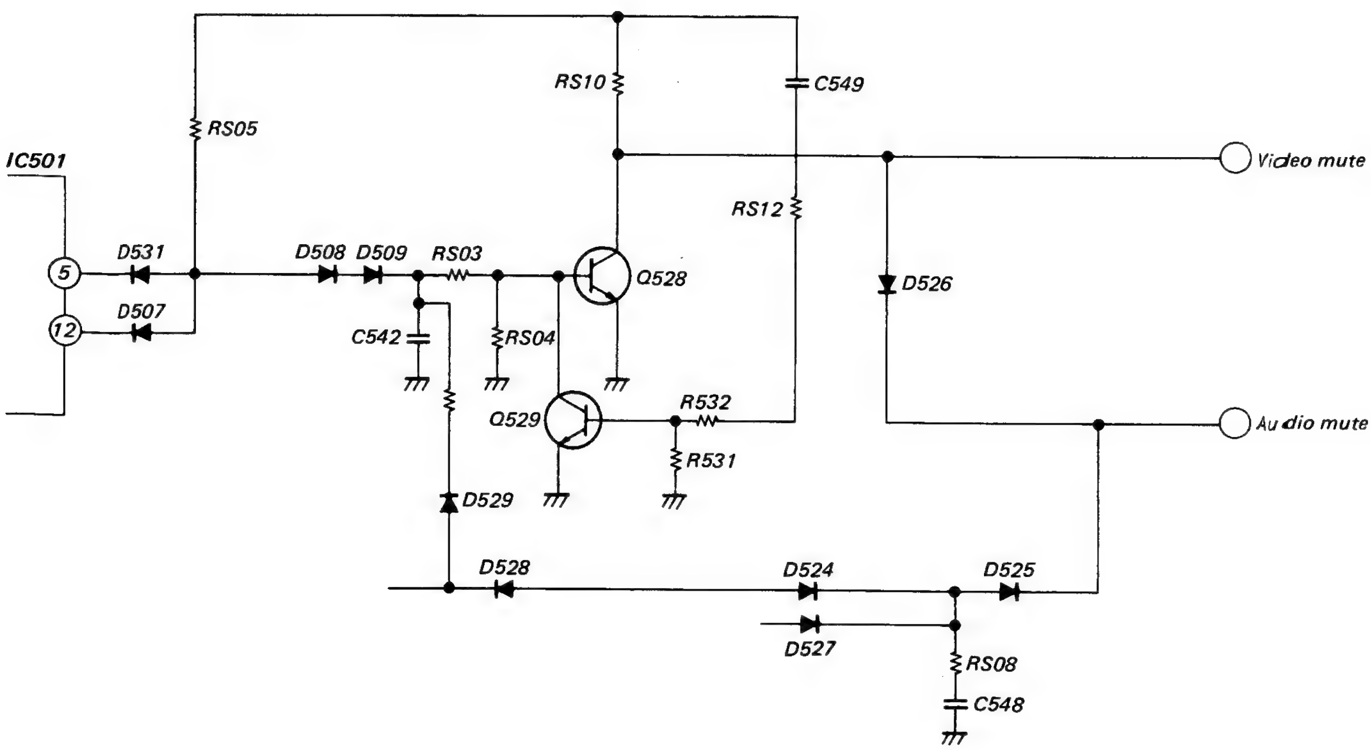
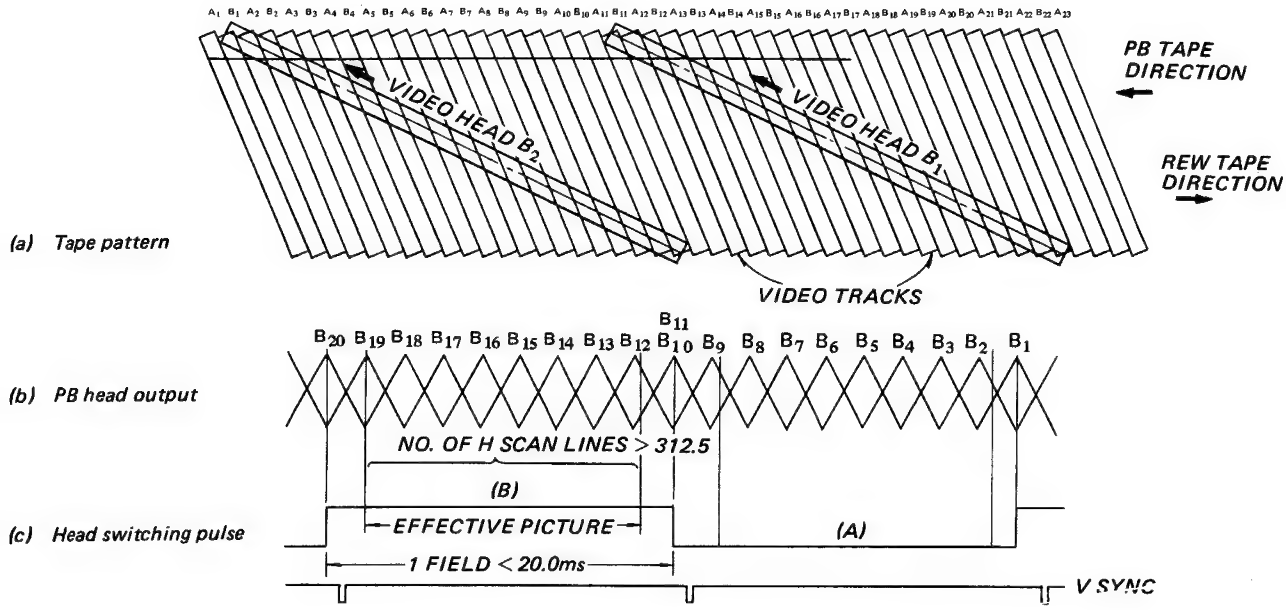
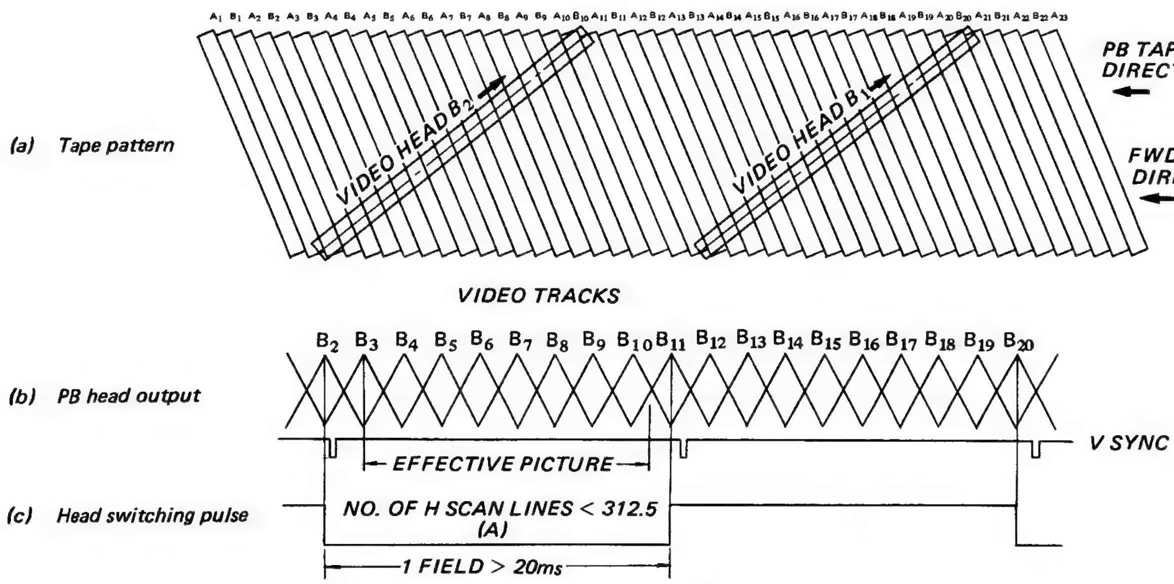


Fig. 3-50 Muting Circuit



a. Rewinding tape pattern and playback output



b. Fast-forward tape pattern and playback output

Fig. 3-51 Head Tracks, Playback Output Envelope, and Switching Pulse PHase in Picture Search

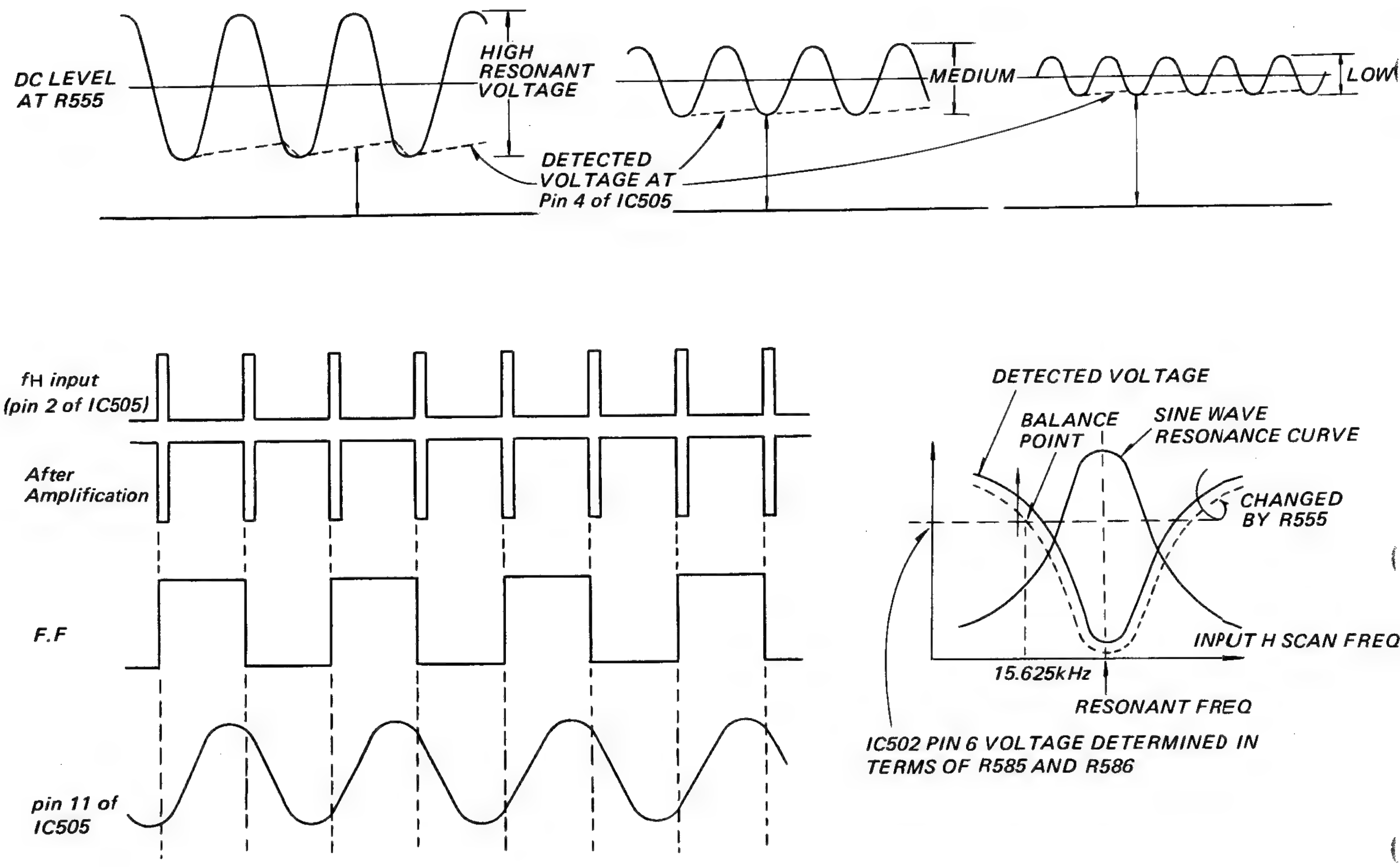


Fig. 3-52 Resonant Voltage Change, Detected Voltage and Time Chart

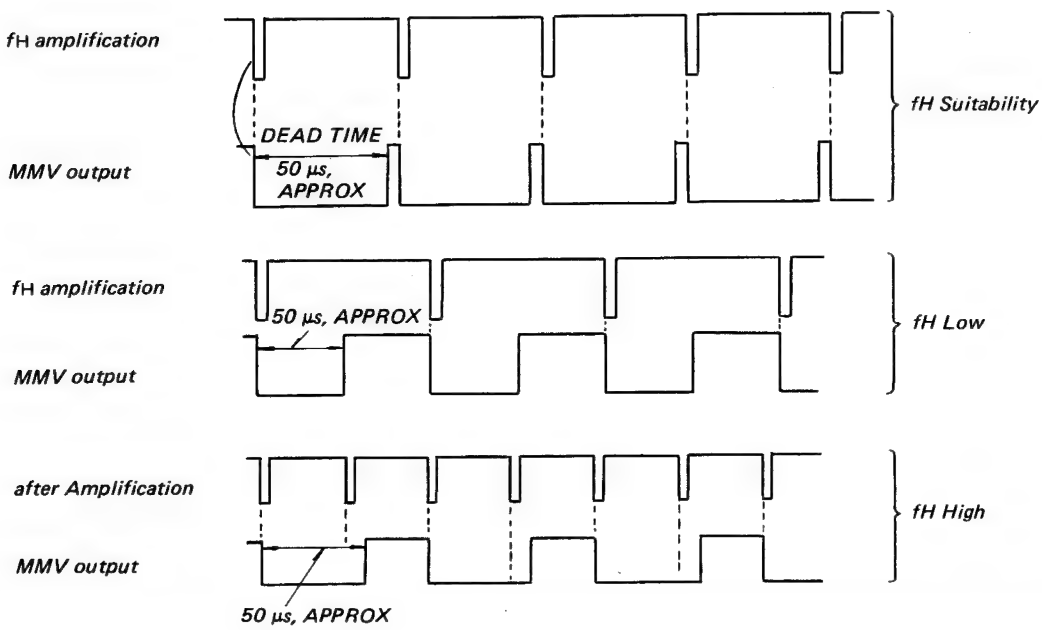


Fig. 3-53 Miss Lock Detector

Also, as the vertical sysc signal is influenced by noise, stable pictures are produced by creating an artificial vertical sync signal with the RF switching pulse in the video board. Parctically all of the circuits are hybrid IC types using IC505 while there are some that use circuit switching transistors. We shall first explain the hybrid IC. The IC is composed roughly of 2 major circuits of which one is a circuit to detect synchronism (detection of speed) of the horizontal sync freqency and other a circuit to detect no-signal condition. The horizontal sync signals from the video board are supplied to pin 2 of IC505 and, after being amplified, it is converted to 50% duty pulses by means of the internal flip flop unit and is caused to resonate in the LC resonance circuit. This resonant point is fixed at a point higher than fH (1/2 demultiplication of 15.625kHz) and, if the frequency changes, the resulting variations in amplitude of the resonating since wave will be detected by a diode. This is smoothed by C518 on pin 4 and appears as an output at pin 10 after current amplification. LC resonance is accomplished by C520, C521 and L501 with C520 and C521 provided to improve temperature characteristics and L501 is a variable coil to enable change of the resonant point. Adjustment that can be carried out with the set is to change the voltage of the resonant point and this is done with R555. For method of detection, see Fig. 3-52. In the mis-lock detection circuit, only noise signals enter during no-signal condition as horizontal sync signals are not generated. Frequency-wise it will become high in this state with the resonant frequency also at a high point and on the opposite side of the resonance curve causing the motor to stop as there will be no detector output. A monostable multivibrator circuit (time constant determined by capacitor C519 and C553 between pins 3 and 6 of IC505 and the internal resistance of IC) is provided to prevent this by detecting this condition (See Fig. 3-53) and switching from the picture search to normal playback mode (APC loop). Switching from picture search to normal playback (APC loop) is carried out by Q513, Q514, D505 and D506. During picture search, Q513 goes on causing the APC output of D505 to drop and Q514 causes the voltage on C525 to become the same as during servo lock. The voltage detected in fH is applied to pin 5 of IC502 by means of D506. The gain in the picture search mode is increased by high gain of closed loop with operating Q525, Q526 and Q527.

Double-Speed Circuit

For double-speed playback, the divided frequencies of the capstan control signal and FG signal are further halved to revolve the capstan as high as two times. Switching of the frequency division is done by making low the level at pin 2 on IC501. The low-level signal is delivered to the Logic Circuit.

In the double-speed playback, both APC and AFC in the capstan servo circuit are locked. Noises are shifted into the vertical blanking by tacking adjustment. As seen in Fig. 3-54, there are two tracking shift directions. They should be corrected with the X2 TRACKING control so that tracking can be shifted in either direction.

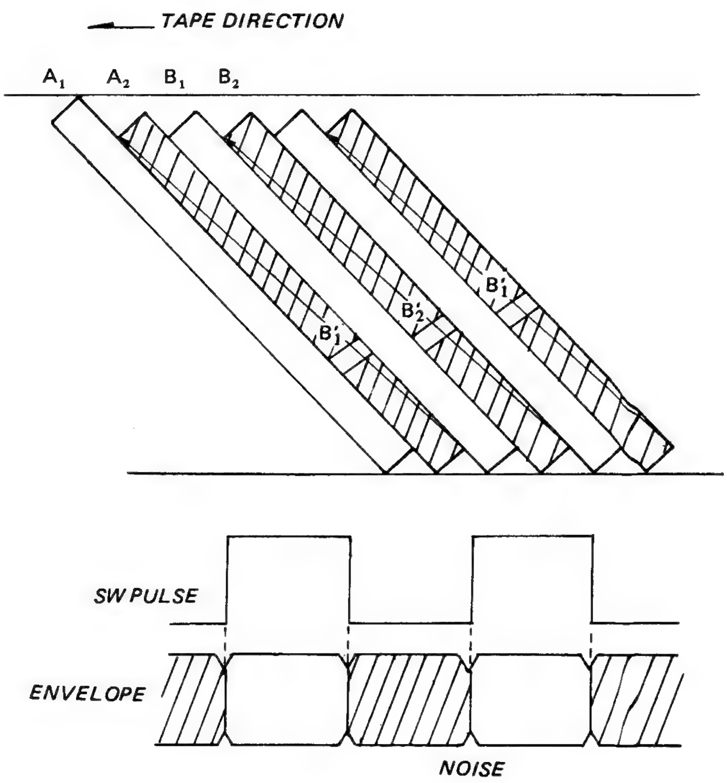


Fig. 3-54 Head Trace for Double Speed Playback

SERVO II CIRCUIT

General Outline of the "slow", "still" and "double speed" Circuits

The clean slow, still circuits and switching pulse changeover circuit are provided on the chassis.

4 Video heads disc are mounted as shown in Fig. 3-55. During normal playback, heads A and B are used while heads B_1 and B_2 are used during slow, still, double speed or dual speed (picture search) playback. The RF switching pulses which are used as the changeover signal are set as shown in Fig. 3-56 during normal playback and slow, still and dual speed picture search playback.

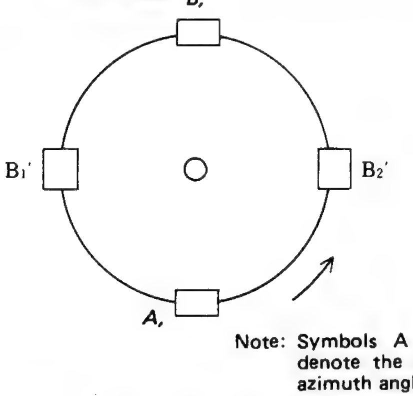


Fig. 3-55 Video Head Mounting Diagram

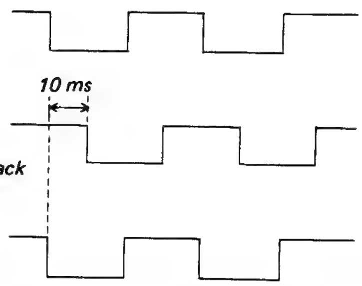


Fig. 3-56 Video Head Output Switching Waveform

The switching pulses for slow, still, double speed and dual picture search playback are created from the TP-501 switching pulses by electrically delaying in a delay circuit. Also, as it will be necessary to switch over the preamp and color reproduction process, during slow, still, double speed and dual picture search playback, slow still and, double speed and dual picture search signals are supplied to the video circuit.

Clean slow reproduction is carried out by repeatedly starting and stopping the tape as shown in Fig. 3-57. When stopping, the playback control signal generated during starting stops the unit so that the video heads B_1 and B_2 are centered as shown in Fig. 3-58. The reason that the centers of B_1 and B_2 are displaced is due to their difference in height.

Timing of tape travel is accomplished by means of the switching pulses and commences with head B_2. The tape travels slong the dotted line shown in Fig. 3-58 and along tracks b_1 and b_2 at approximately the same speed as in normal playback, and is also stopped on track b_2.

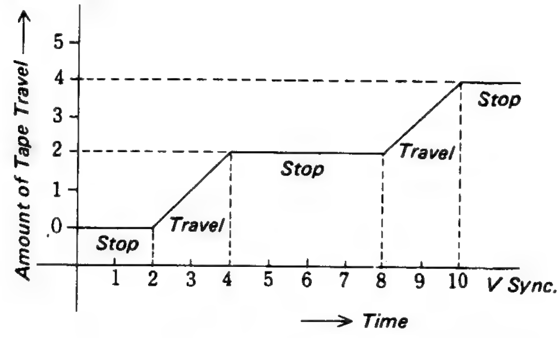


Fig. 3-57 Tape Travel During Slow Playback

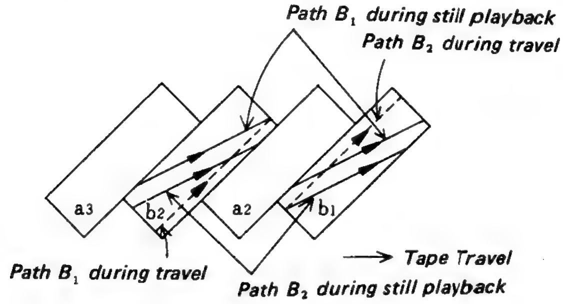


Fig. 3-58 Head Path During Slow Playback

In double speed playback, capstan servo is used so head path will be as shown in Fig. 3-59. Noiseless double speed playback is therefore carried out as the head travels along track b at practically all times.

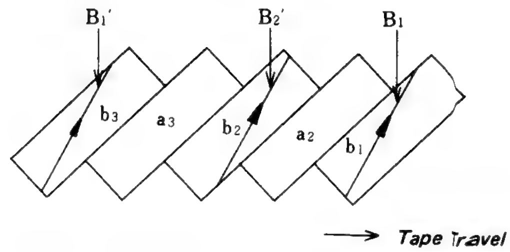
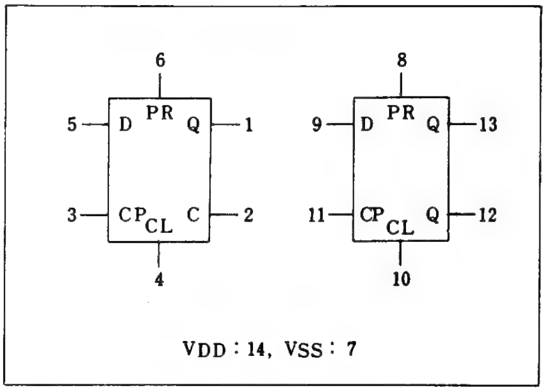


Fig. 3-59 Head Path During Double Speed Playback

BLOCK DIAGRAM



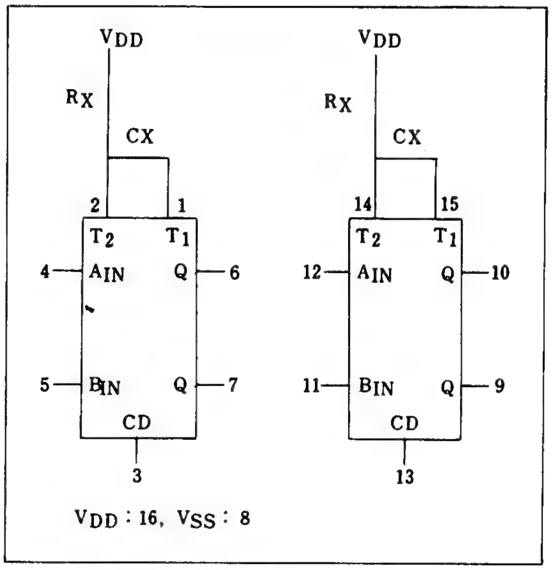
TRUTH TABLE

INPUTS				OUTPUTS	
CL	PR	D	CP △	Q	$\overline{Q}$
L	H	✱	✱	H	L
H	L	✱	✱	L	H
H	H	✱	✱	L	H
L	L	L	↑	L	H
L	L	H	↑	H	L
L	L	✱	↓		

✱ : Don't Care
△ : Level Change

TC4013BP D Type Flip Flop

BLOCK DIAGRAM



TRUTH TABLE

INPUT			OUTPUT		NOTE
A	B	CD	Q	$\overline{Q}$	
↑	H	H	⊓	⊔	OUTPUT PULSE
↑	L	H	L	H	INHIBIT
H	↓	H	L	H	INHIBIT
L	↓	H	⊓	⊔	OUTPUT PULSE
✱	✱	L	L	H	INHIBIT

✱ Don't Care

TC4528BP Delay circuit

Slow, Still Signal Circuits (Fig. 3-60)
When changing over from reproduction to slow, still, a slow + still signal from the logic control circuit enters pin 5 of PY08 as a high level signal. On one hand it is fed to the base of QY26 to suppress the playback servo signal and stop the capstan motor. On the other hand, it is fed to pin 5, which is the D input of the D flip flop of IC Y04 after delaying in the integrating circuit by means of RY17 and CY08. D flip flop functions to transmit D input signals to Q output with clock pulse rise timing.
The RF switching pulse from the servo logic circuit enters pin 3 of PY08 and, after being inverted and amplified in QY07, are fed as clock pulses to pin 3 of IC Y04. The previously explained D input causes the (Q) output of pin 1 of IC Y04 to invert at high level and the (Q) output of IC Y04 to invert at low level with the rise of the inverting switching pulse input after level of pin 5 has exceeded its threshold level. These signals are used for the switching signals for the slow circuit. Also, when changeover is carried out to modes other than slow and still, the slow + still signals become low level and D input causes pin 1 of IC Y04 to invert to low level and pin 2 of IC Y04 to invert to high level according to the rise of the inversion switching pulse which has dropped below the low threshold level. The slow, still modes are cleared with these inversions.

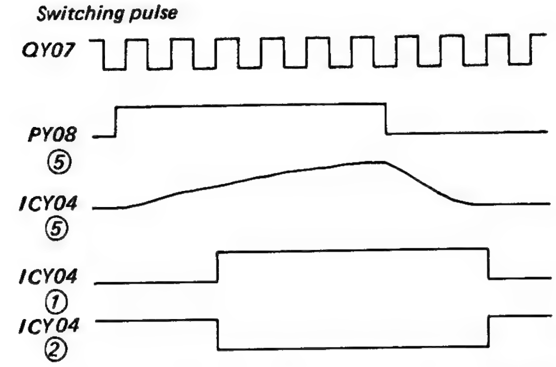


Fig. 3-60 Timing Chart for Slow, Still Changeover Timing

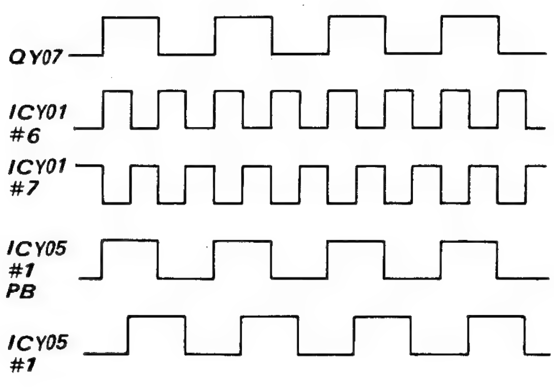


Fig. 3-61 Switching Pulse Changeover Circuit Timing Chart

Switching Pulse Changeover Circuits
As heads B_1' and B_2' are used during slow, still, double speed and dual picture search playback, it will be necessary to delay the switching pulses approximately 10 msec from the switching pulse during normal playback. It will therefore be necessary to supply normal switching pulses during normal playback and delayed switching pulses during slow, still and double speed playback. These changeover signals are created in IC Y04. As pin 8 (Preset Terminal) of IC Y04 is at high level, when pin 10 (Clear Terminal) is made low, pin 13 of out put Q becomes high and $\bar{Q}$ pin 12 becomes low. Pin 2 of IC Y04 becomes low during slow and still and pin 10 of IC Y04 also becomes low through D09. Also, during double speed playback, dual speed picture search signals are fed to pin 4 of PY08 at low level and, passing through RY34, causes pin 10 of ICY04 to become low. In other words, pin 13 of ICY04 becomes high, pin 12 of $\bar{Q}$ becomes low during slow, still and double speed playback and pins 13 and 12 of Q become low in other modes.
This $\bar{Q}$ output is also inverted by QY15 and supplied to the video circuit as color signal processing switching signals from pin 3 of PY04. Switching pulses inverted and amplified by QY07 are fed to the delay circuit in IC Y01. The delay IC functions to delay the pulses from the rise of input pulse A by a delay time determined by the time constants of CY13, RY51 and RY44; and to also delay the pulses from the fall of the B input pulses by the same delay time. This function is possible only when the CD terminal is in high condition.
The input switching pulses are differentiated by CY11 and RY45 and by CY12 and RY47 and fed respectively to A and B of pins 4 and 5 of IC Y01. Therefore, signals delayed from the rise and fall of the switching pulses shown in the time chart can be obtained from pins 6 and 7 of IC Y01. RY46 and RY48 here are resistors to protect the IC.
These delayed signals are used as block inputs for the D flip flop of IC Y05. Inverted switching pulses are fed to pin 5 of IC Y05. Therefore, if we use the signal from pin 7 of IC Y01 as the clock input, pin 1 of IC Y05 will be inverted where the delayed signal appears as the rising portion of the signal is the delayed signal. The delayed signal of the inverted switching pulses will appear as outputs at Pin 1. Again if we use the signal on Pin 6 of IC Y01 as the clock input, a signal that is minutely delayed from the inverted switching pulse will appear as an output at Pin 1 of IC Y05 as the rising portion of the clock pulse will be at a minutely delayed position equal to the lag from the switching pulse changeover to the operation of IC Y01. Therefore, by switching over the clock input, the output of Pin 1 of Y05 will be changed from a delayed signal to a non-delayed signal. This clock changeover is carried out by DY17, DY18, DY19 and DY20 from the output of Pins 12 and 13 of IC Y04 previously explained. The output of Pin 1 of IC Y05 is inverted by QY16 and fed to the video circuit through Pin 1 of PY04.

Slow Circuit (Fig. 3-62, 63)

As explained in the foregoing general outline, the slow circuit acts to move the tape along the head path where the reproduction head output is sufficiently high.

The switching pulses inverted by QY07 are fed to Pin 12 (A) of IC Y01 and are delayed for a certain period determined by CY01, RY12 and RY53. This serves the purpose of timing the generation of motor drive pulses and also timing tape travel. This delayed output is fed from Pin 9 (Q) of IC Y01 to Pin 4 (A) of IC Y02 and pulses with width determined by the slow speed VR in the remote unit, CY02, RY06 are obtained. Slow speed is determined here to determine the time until the next drive. Furthermore, this IC is activated as Pin 3 (CD) of IC Y02 is at high level during slow operation. When Pin 3 is at low level, generation of drive pulses for the next stage is inhibited as the delay circuit of the IC is inactivated and the delay output remains at a fixed level. Pulse outputs from Pin 6 (Q) of IC Y02 are fed to Pin 4 (A) of IC Y03 and pulses with width determined by CY04, RY24 and RY57 are obtained.

As the input to Pin 4 of IC Y03 is triggered by pulse rises, the pulses on Pin 6 of IC Y02 and Pin 6 of IC Y03 rise practically simultaneously. As the output from Pin 6 of IC Y03 is the motor drive time, it determines the drive voltage as well as the tape travel speed. DY39 and DY40 are for temperature compensation.

Output (Q) of Pin 6 of IC Y02 is fed simultaneously to Pin (11) (CP) of IC Y05 and causes the output (Q) of Pin 13 of IC Y05 (D flip flop) to go to low level. When tape is fed by means of drive pulses, playback control signals are supplied by the control head during tape travel. This signal is amplified in the servo circuit and is fed to Pin 1 of PY08. The stop pulses only are amplified and formed by DY12, RY36, CY09, RY37 and QY14 and negative pulses are obtained from QY14. This signal is fed to Pin 12 (A) of IC Y02 where it is delayed by a time determined by CY10, RY55, RY01 and the tracking VR in the remote control unit. This delay determines the time from control scanning to braking and determines the tape stopping position.

This delay output is obtained from Pin 9 (Q) of IC Y02 and differentiated by CY15, RY41 and positive pulses only are fed to Pin 8 (preset terminal) of IC Y05 through DY04 and causes Pin 13 (Q) to go to high level. Pin 13 (Q) output is fed to Pin 12 (A) of IC Y03 and generates pulses in Pin 9 of IC Y03 with width determined by CY05, RY26, and RY58. This is used as the brake pulse to apply reverse voltage on the motor and cause the motor to stop suddenly. The drive output from the Pin 6 of IC Y03 is fed to Pin 10 (clear terminal) of IC Y05 and prevents Pin 13 from going to high level and also prevents the generation of brake pulses while drive pulses are emitted even if there is an input to Pin 8 of IC Y05. The output ($\overline{Q}$) of Pin 9 of IC Y03 is connected to Pin 3 of IC Y03 and prevents the generation of drive pulses while brake pulses are being generated. Simultaneous generation of drive pulses and brake pulses are prevented in this manner and thus prevents overcurrents in the drive output transistor. The drive circuit is constructed as shown in Fig. 3-62 and, during drive, QY33 and QY23 are turned on to cause the motor to turn in the correct direction. QY23 only is on during the period from the end of the drive pulse to the start of the brake pulse and no voltage is therefore impressed across the motor terminals.

QY32 and QY25 goes on and applies reverse voltage to the motor to bring it to a positive stop. When stopping, QY23 and QY25 goes on and shorts out the motor terminals. In other words, the drive pulse outputs (negative pulses) from Pin 7 of IC Y03 is impressed on the base of QY18 through RY27 and turns QY18 off only during drive. The voltage determined by RY59, RY99 and RY67 is impressed on the base of QY33 through DY29.

As the brake pulse output (negative pulse) from Pin 9 of IC Y03 is impressed on the base of QY22 through RY77, QY22 and QY23 are turned on and the negative terminal of the motor is at 0 volts at all times except when braking. The brake pulse output (negative output) from Pin 9 of IC Y03 is impressed on the base of QY19 through RY28 and turns QY19 off only when braking. The voltage determined by RY71 and RY72 is impressed on the base of QY32 at this time.

As output (Q) from Pin 13 of IC Y05 is impressed on the base of QY24 through RY25, QY24 and QY25 is turned on and the voltage is approximately zero except during the period from the start of the drive pulses to the start of the brake pulses. The function of Fig. 3-60 previously explained is thus carried out in this manner.

A thermistor is also provided on the motor to compensate for the motor characteristics during low temperatures by increasing the resistance value, lowering the voltage on the base of QY20, increasing the current in the collector and thus increasing the drive voltage.

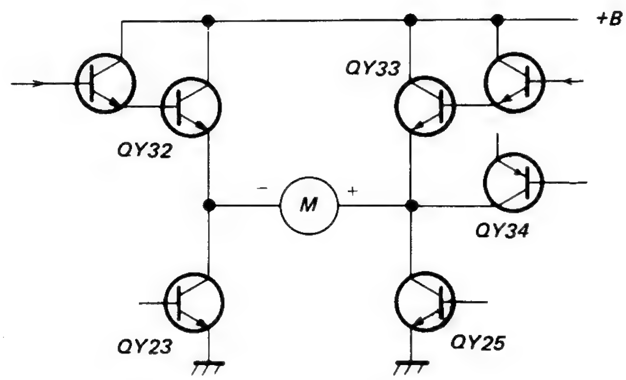


Fig. 3-62 Capstan Motor Drive Circuit

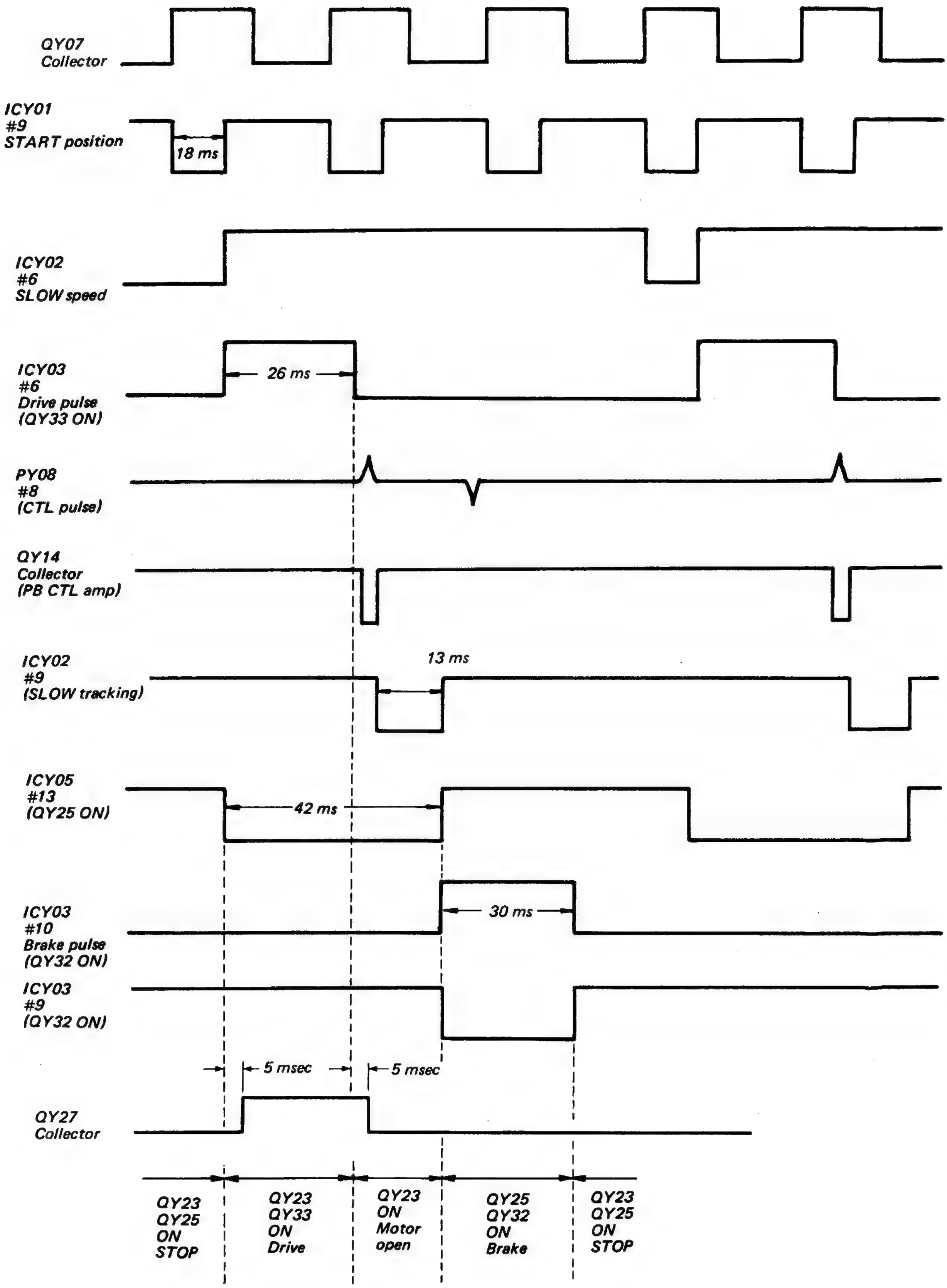


Fig. 3-63 Slow Playback Timing Chart (In the Case of 1/3 Slow)

Disc Correction Circuit
The relative speed of the tape head and video track varies during slow playback, tape travel and tape stopping causing the horizontal frequency of the playback video signal to vary and the image on the TV screen to drift horizontally. To reduce this drift, disc revolution is increased during tape travel. The time required for the tape to actually commence moving after the drive voltage is impressed on the capstan motor is approximately 7 msec after the voltage is applied. As another 25 msec is required for the tape to reach maximum speed, a disc correction pulse is applied to the DC amp input (Pin 5 of IC 502) of the disc servo approximately 5 msec after the drive pulse to match the timing of the increase in tape travel speed and disc revolution.

Still Changeover Circuit (Fig. 3-64)
Still reproduction is accomplished by stopping the tape after feeding the tape at the maximum slow speed playback speed. During still operation, the still signals from Pin 3 of PY01 and the still + slow signal from Pin 5 of PY08 are simultaneously applied. The still signals turns QY09 on and sets the unit to maximum slow speed (1/3). Furthermore, the voltage impressed on Pin 3 of IC Y02 from Pin 1 of IC Y04 through RY22 will be inhibited by still signal applied through DY08. Pin 2 of IC Y04 is set to low level by the slow + still signal which also sets Pin 3 (CD Terminal) of IC Y02 to high level through QY10 and activates the circuit for slow mode operation. The voltage on the base of QY10 rises in accordance with the time constants of CY03 and RY21. QY10 finally goes off and Pin 3 of IC Y02 is set to low causing the delay circuit to stop functioning and stopping the generation of the pulses. Several pulses are generated during this period causing the tape to stop at a spot where noise is not emitted.

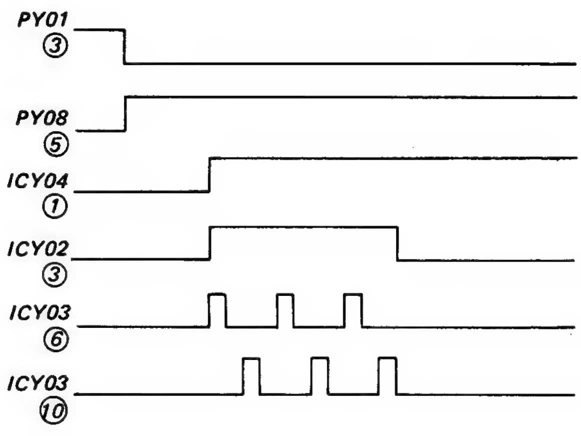


Fig. 3-64 Still Playback Timing Chart

Slow, Still Playback and Standard Playback Changeover
During slow, still playback, the capstan drive signal input to Pin 2 of PY08 from the servo circuit is inhibited and QY30, QY31 and QY34 are turned off. During standard playback, QY26 goes off, the capstan drive signal from the servo circuit is applied to the base of QY30 and voltage from the collector of QY34 is impressed on the positive terminal of the capstan motor. Also, during standard playback, Pin 2 of IC Y04 is set to low level, the delay circuit formed by Pins 1 to 8 of IC Y02 and Pins 9 to 16 of QY03 is stopped, Pins 7 and 9 of IC Y03 are fixed at high level and the drive and brake output transistors of QY32 and QY33 are turned off. QY23 also goes on and the negative terminal of the capstan motor drops to ground potential. The base of QY24 is lowered through DY21 and QY24 and QY25 are turned off. Changeover between standard playback or recording mode and trick playback mode are carried out by the foregoing procedure.

Slow Tracking VR Switching Circuit (Fig. 3-65)

Slow tracking adjustments are carried out by means of the tracking VR in the remote control unit when the remote control unit is connected and by means of the tracking VR in the set when the remote unit is disconnected. When remote control is connected, the slow tracking VR in the remote unit is connected to Pin 1 of PY02 and also to RY01 and RY55 through DY10. At the same time, remove control detector signals (+12V) from Pin 3 of PY02 are applied to the base of QY13 from RY35 through DY27, QY13 is turned on, the connecting point of the tracking VR in the set from Pin 2 of PY01 is dropped to ground potential, DY11 is cut off, and the tracking VR in the remote unit only is connected to the slow tracking time constant circuit. When carrying out standard playback and double speed playback with remote control, Pin 1 of IC Y04 goes to low level causing the base of QY13 to drop through DY28 and DY27 and QY13 to go off, and thus prevents any effects on the tracking VR. When the remote unit is disconnected, QY13 goes off and the tracking VR in the set is connected to RY01 and RY55 through DY11.

Double Speed Playback Tracking Circuit

During double speed playback, the double speed signal goes to low level and is connected to the center tap of the tracking VR in the set through D504, R522, R554 and R521; and lowers the potential of the center tap to increase the amount of tracking delay. Adjustments are made by means of R554 for minimum noise during double speed playback of self-recorded tape at the click point of the tracking VR.

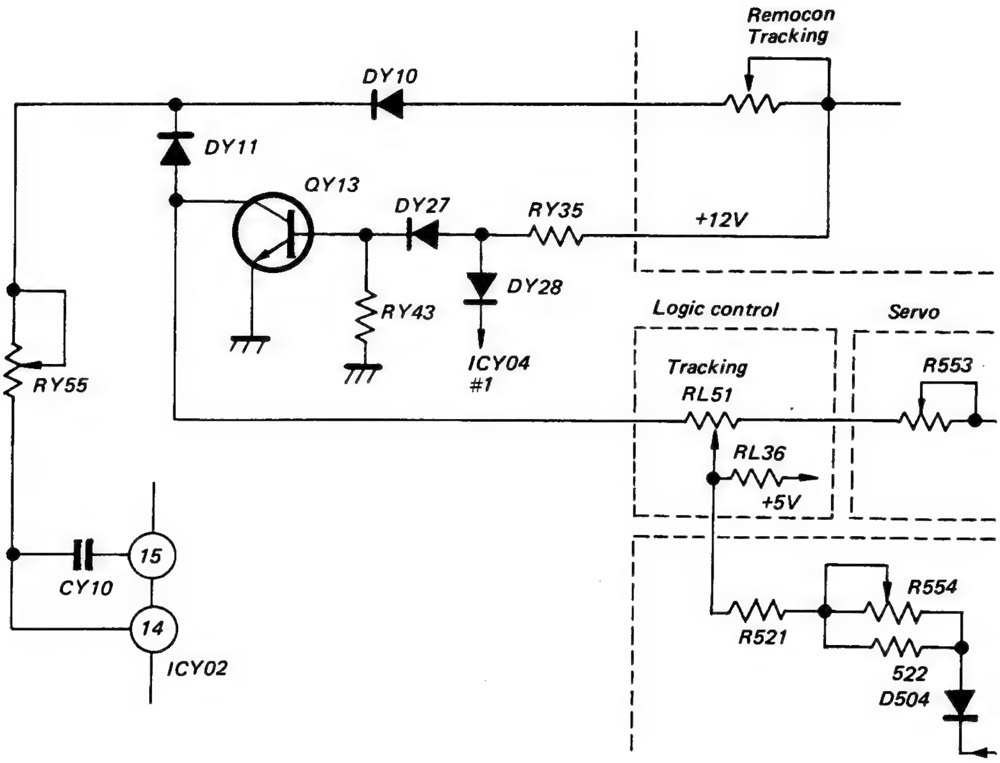


Fig. 3-65 Slow Tracking VR Switching Circuit and Double Speed Tracking Circuit

3-5 LOGIC CONTROL SYSTEM

Introduction

The Logic Control System consists of a System Control Circuit board containing a micro-computer TMP4320P, a Front Control Circuit board having inputs of setting a desired mode of operation, and a Solenoid Drive Circuit board for energizing functional plunger solenoids.

The System Control Circuit where the single-chip 4-bit micro-computer TMP4320P functions as the heart outputs motor on-off signals, plunger solenoid on-off signals, LED (light-emitting diode) on-off signals, and power on-off signals for each mode of operation. These on-off features provide direct mode switching that is impossible by conventional logic control mechanisms.

A single hybrid in the Logic Control System houses a variety of sensor circuits, thereby reducing the number of component parts used. In addition, a new timing adjustment circuit is provided, which prevents playback picture noises which were seen at pause spliced points in recording edition by usual models.

Construction

Fig. 3-66 is a block diagram for the Logic Control System, including the System Control Circuit, Front Control Circuit, and Solenoid Drive Circuit.

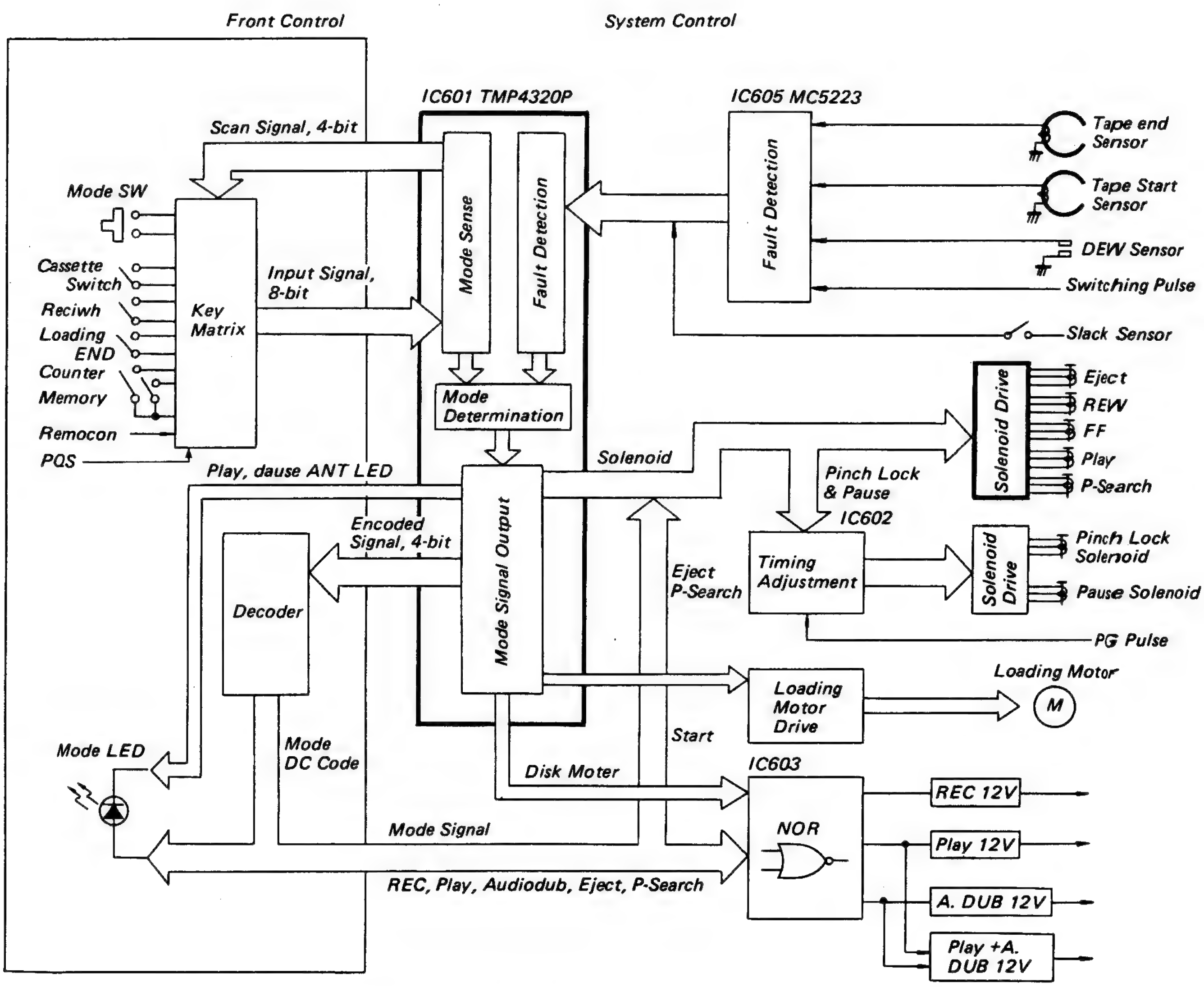


Fig. 3-66 Logic Control System Block Diagram

Description of Major ICs
TMP4320P (IC601)
1. General

TMP4320P, which is a single-chip 4-bit microcomputer fabricated in a N-CH MOS process, has a ROM of 8 bits by 2048, a RAM of 4 bits by 128, 3 input ports of 12 bits, 4 output ports of 15 bits, and 2 input/output ports of 8 bits. The IC is housed in plastic DIP package, which has 42 pins as shown in Fig. 3-67. The IC provides such major functions as to input the signals from the operating key switches, sensors, and microswitches, to determine the mode, to determine whether the mode switching can be accepted or not, and to issue signals for driving corresponding plunger solenoids, illuminating corresponding LEDs, starting or stopping the motors, and others. For more detail, see Table 3-1.

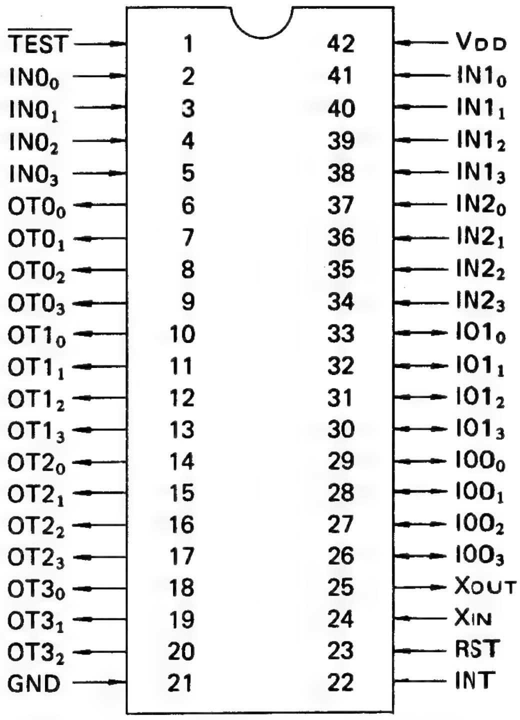


Fig. 3-67 TMP4320 Pin Configulation

Table 3-1 TMP4320 (IC601) Pin Input and Output Sygnals and Logic Levels

Pin No.	Input or Output	Description
1	–	TEST (NC)
2	–	
3	IN	LOW input when disk motor is not revolving.
4	IN	P.O.S.
5	IN	LOW input when dew develops or tape slacks.
6	OUT	LOW output when play solenoid is energized.
7	OUT	LOW output when rewind solenoid is energized.
8	OUT	LOW output when fast-forward solenoid is energized.
9	OUT	LOW output when pinch lock solenoid is energized.
10	OUT	LOW output when pause solenoid is energized.
11	–	
12	OUT	LOW output when PLAY LED is lit.
13	OUT	LOW output when PAUSE LED is lit.
14	OUT	LOW output when PQS LED is lit.
15	–	
16	OUT	LOW output when ANTENNA indicator is in VCR.
17	OUT	LOW output when disk motor is revolving. Also, used to turn heater off when it is revolving.
18	–	
19	OUT	LOW output when loading motor is in loading.
20	OUT	LOW output loading motor is in unloading.
21		Ground
22	–	INT (NC)

Pin No.	Input or Output	Description
23	IN	RESET, or RESET with LOW input.
24		Clock from 455 kHz ceramic oscillator.
25		
26	OUT	Encoded mode signal outputs (see Table 3–9).
27	OUT	
28	OUT	
29	OUT	
30	OUT	Scan 4 output
31	OUT	Scan 3 output
32	OUT	Scan 2 output
33	OUT	Scan 1 output
34	IN	Input 8
35	IN	Input 7
36	IN	Input 6
37	IN	Input 5
38	IN	Input 4
39	IN	Input 3
40	IN	Input 2
41	IN	Input 1
42		VDD, 5 V

NOTES: The HIGH level is 5 V and the LOW level 0 V. The dash (—) indicates that the pin is not connected (NC).

Table 3-2 Output of IC601 (Micro Computer)

PIN NO.	MODE / OUTPUT	LOAD-ING	EJECT	REW	STOP	FF	AUDIO DUB	AUDIO DUB PAUSE	REC	REC PAUSE	RE-VIEW	PLAY	STILL	CUE	X2
6	PLAY SOL						○	○	○	○		○	○		○
7	REW SOL			○							○				
8	FWD SOL					○								○	
9	PINCH LOCK SOL						○		○			○	○		○
10	PHASE SOL							○		○					
12	PLAY											○	○		
13	PAUSE							○		○			○		
16	ANT						○	○			○	○	○	○	○
17	DISK MOTOR			○		○	○	○	○	○	○	○	○	○	○
19	LOADING M. +	○													
20	LOADING M. –		○												
26	DECODER A		○			○	○	○			○				
27	DECODER B		○	○					○	○	○				○
28	DECODER C		○	○		○					○		○		○
29	DECODER D		○	○		○	○	○	○	○			○	○	

* ○ → LOW LEVEL

2. Internal Functions

(1) Automatic rewinding: When the end of the tape running in a forward direction as in the playback, recording, or similar mode of operation is detected with the AUTO REW switch turned on, the VCR is automatically set to the rewinding mode. In the timer-controlled recording, the automatic rewinding cannot be done.

(2) Counter memory: When the tape counter reaches "9-9-9-9" in the rewinding mode of operation with the COUNTER MEMORY switch turned on, the VCR is set to the STOP state.

(3) Automatic TV-VCR Switching: When the VCR is switched to the playback, audio dubbing, cue, review, or double speed mode of operation, it is automatically set for use of the VCR. By depressing the TV-VCR selector pushswitch in and out, either of the VCR or TV is selected cyclically for operation.

(4) Timer-controlled recording: The timer output signal sets the VCR in the recording mode with the REC INH switch turned off. In the timer-controlled recording, all the key input and remote control signals except the TV-VCR selector cannot be accepted. The automatic rewinding cannot be done even if the AUTO REW switch is turned on.

(5) Camera pause: The camera pause signal, if coming from the TV Camera during the recording mode, sets the VCR into the recording pause mode. If it is disconnected, the VCR is reset to the recording mode. The signal is not effective in the timer-controlled recording.

(6) Automatic pause resetting: Any of the recording pause, audio dubbing pause, and still mode is reset in approximately 6 min 30 sec since the VCR was halted. Note that in the camera pause, it is switched over to the stop state.

(7) Loading motor protection: In the event tape loading operation continues longer than 12 sec, the VCR is automatically switched over to unloading operation. If unloading takes longer than 20 sec, also, it is automatically stopped. These preventive operations are needed to protect the loading motor against too high load.

(8) Disk motor protection: A faulty stop of the disk motor automatically switches the VCR over to the stop state. This switching feature does not function until approximately 8 sec elapse after the start of the disk motor. If in the timer-controlled recording the disk motor will not start with the feature doing three times of action, the VCR is switched over to the stop state.

(9) Dew and tape slack prevention: If the low dew or tape slack signal comes in, this prompts any mode of operation to be switched over to the stop state. The low signal prevents any of the operating key signals and remote control signals except the EJECT key signal from being accepted until the low signal goes off. If the VCR is in tape loading operation, the low signal switches it over to unloading operation.

(10) Record safety: If the REC INH switch is on, the record safety feature inhibits any mode of operation from being switched over to the recording or audio dubbing mode.

(11) Tape end detection: If the end of tape is detected in a forward mode of operation such as playback or if the beginning is detected in a reverse mode of operation such as rewinding or review, then any mode is switched over to the stop state. In such a tape end detection in the forward mode of operation with the AUTO REW switch turned on, however, it is switched over to the rewinding mode. Also note that in the timer-controlled recording, the tape cannot be automatically rewound.

(12) Tape sticking prevention: When tape loading ends or the fast-forward, rewinding, cue, or review mode of operation is switched over to the stop mode, the play solenoid is energized to actuate the tension lever to slacken the tape. When the playback, recording, or audio dubbing mode of operation is switched over to the stop state, the tension lever is released to slacken the tape.

(13) Automatic backet lifting: If a tape cassette is not in the backet with the cassette detect switch held off, the backet is automatically lifted up when power is turned on. Note that if the tape cassette is in the backet, the tape is loaded.

(14) Remote control inputs: The 4-bit binary-coded remote control signal from PR01 is accepted at the time when the strobe is low. The signal is decoded in the microcomputer for remote control. Table 3-3 shows a remote control code.

(15) PQS (Programme quick select): PQS system picks up the start of a programme recorded on the tape so that the tape can be automatically stopped at the start point from which the programme is to be started.
Such as PQS operation is made in the manner that a mark signal is put on the control signal as this is recorded on the tape, and is detected as the start sign while the tape is in fast-forward or rewind. When counter memory switch is on during rewind, PQS operation will be inhibited in rewind side, and also, when cassette is ejected, PQS mode will be automatically released.

Table 3-3 Remote Contol Code

MODE	D	C	B	A
–	H	H	H	H
STOP	H	H	H	L
CUE	H	H	L	H
REVIEW	H	H	L	L
–	H	L	H	H
–	H	L	H	L
PLAY	H	L	L	H
Double Speed	H	L	L	L
–	L	H	H	H
PAUSE/STILL	L	H	H	L
–	L	H	L	H
–	L	H	L	L
–	L	L	H	H
–	L	L	H	L
–	L	L	L	H
–	L	L	L	L

NOTE: A remote control key has priority to any key except the PAUSE/STILL key on the VCR body when they are depressed at the same time.

3. Initialization

It is necessary to initialize the microcomputer so as to begin execution of the program from a certain address when power is turned on. This is made in the manner that the reset (active low) pin 23 on IC601 is set to the low level. A usual initializing circuit is an integrating network to which an additional diode is placed as illustrated in Fig. 3-68.

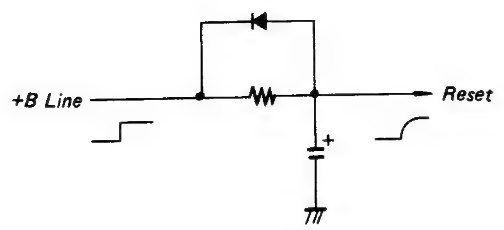


Fig. 3-68 A Simple Initializing Network

The initializing circuit used in the present Logic Control System provides a secure resetting upon a momentary service interruption as constructed in Fig. 3-69. The usual initializing network in Fig. 3-68 is not involved in any problem as long as the period of service interruption is rather long. Too short interruption can possibly cause the program to run away when the line becomes recovered with the voltage at the reset pin on the microcomputer being near the threshold level. In the present initializing circuit in Fig. 3-69, the decrease of the line voltage prompts the zener diode D605 to securely turn Q617 off, which turns Q618 on. This assures that the reset output goes down to the low level.

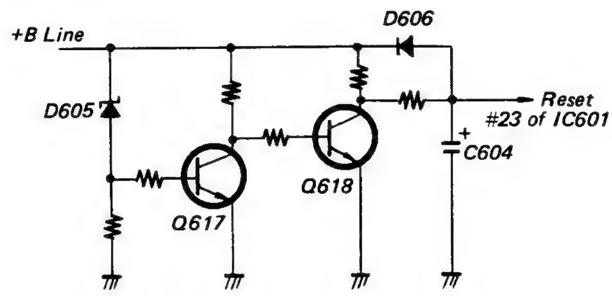


Fig. 3-69 Initializing Circuit Used in Present Logic Control Circuit

MC5223 (IC605)

1. General

MC5223 is 21-pin SIP hybrid IC having sensor and associated circuits. It provides tape end detections at the beginning and end of tape disk motor revolution detection, dew detection, and similar functions.

2. Circuit Operation

Fig. 3-70 shows MC5223 and associated circuits.

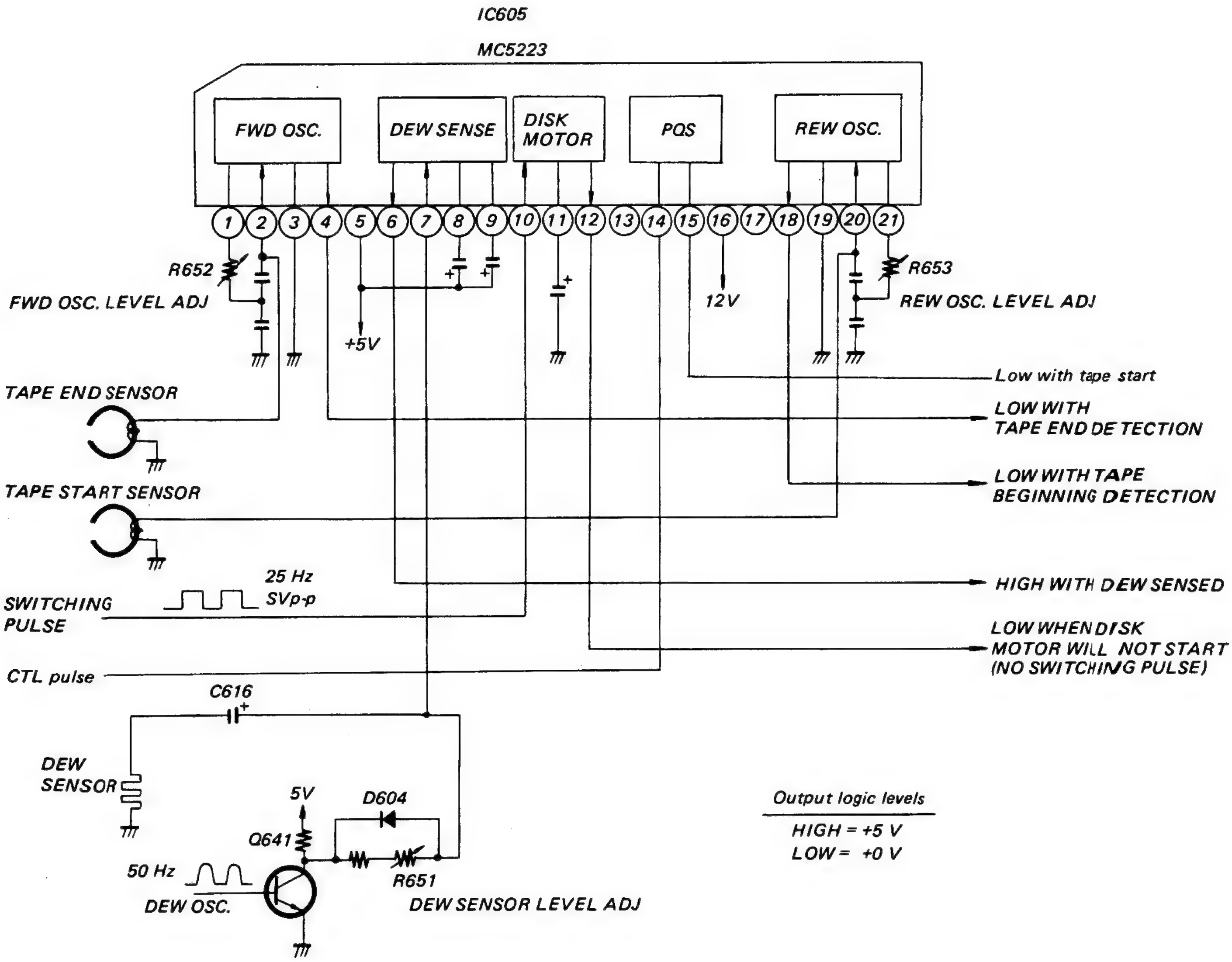


Fig. 3-70 MC5223 and Associated Circuits

(1) Tape end detector: The tape beginning detector and tape end detector circuits are the same in the construction. The tape end detection circuit having a forward sensor, therefore, is described below.
The tape end detector circuit, as shown in Fig. 3-71, is made up of a LC oscillator, consisting of Q4, inductance component of the tape sensor, and capacitor. When the metal foil attached to the end of tape comes close to the tape sensor, the Q of the tape sensor coil decreases. This stops the oscillation. The oscillation frequency *f* is approximately 200 kHz.
When the oscillation stops, Q5 is turned off, which turn Q6 on. The output at pin 4 goes to low. The low output indicates that the tape end has been detected.

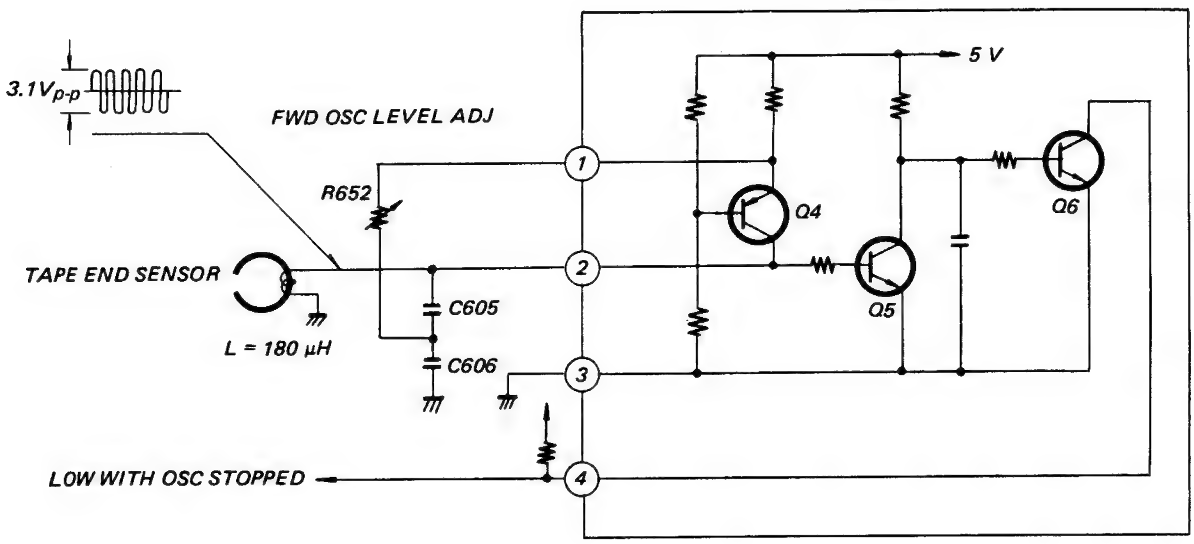


Fig. 3-71 Tape End Detector Circuit

(2) Dew detector: As shown in Fig. 3-72, a 50 Hz, 4 Vp-p to 6 Vp-p pulse is applied to pin 7 on IC605. If dew is sensed, the resistance component of the dew sensor decreases. The result is that the amplitude of the pulse becomes low. The low pulse is connected through Q11 to the Schmitt trigger circuit, consisting of Q12 and Q13. When dew is sensed, Q12 is turned off and Q13 on. This turns Q14 on, which makes the output at pin 6 high.
To reset the dew detection state, a reset pulse to be applied to pin 7 must have a hysteresis allowance higher than the pulse amplitude for dew detection. The reason is that Q12 and Q13 form the Schmitt trigger. Such a feature prevents a sort of oscillation that the dew detector circuit repeats detection and reset, when the pulse input is critical in the detection amplitude.

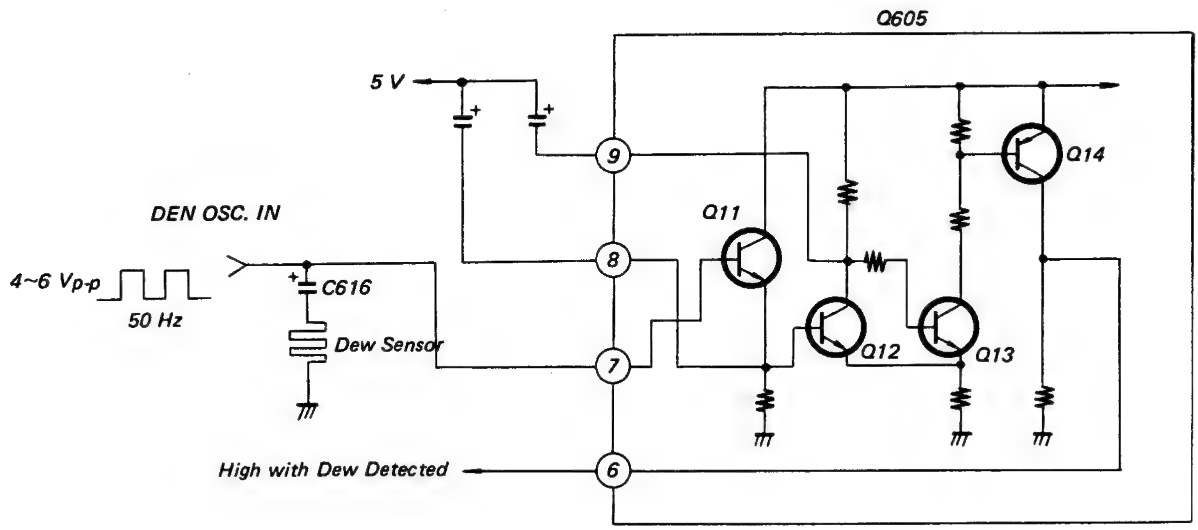


Fig. 3-72 Dew Detector Circuit

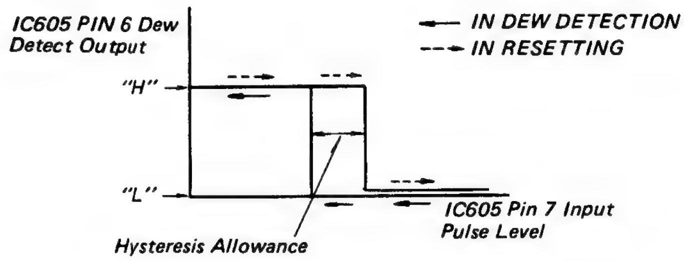


Fig. 3-73 Dew Detection Hysteresis Characteristic

(3) Disk motor revolution detector: This detects the revolution of the disk motor by the presence or absence of the switching pulse as illustrated in Fig. 3-74. If the switching pulse is present, Q16 is turned off. If it becomes absent, Q15 is turned off, which turns Q16 on. This makes the output at pin 12 go to the low level.

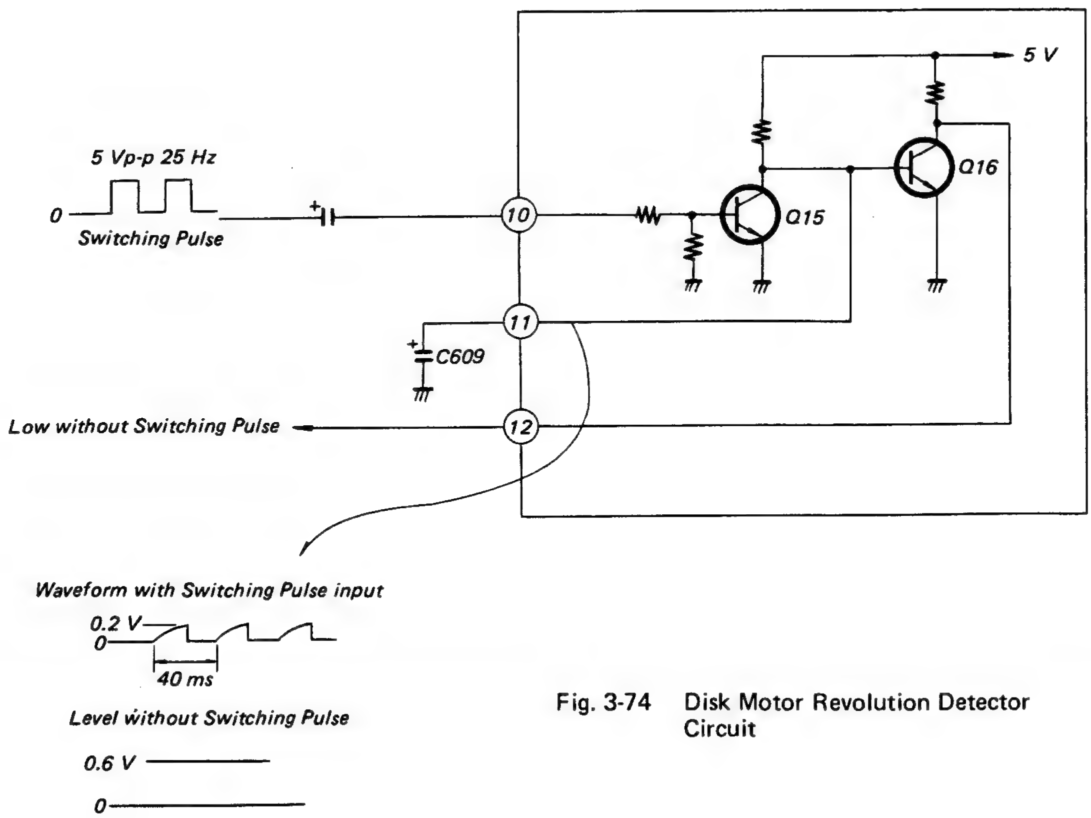


Fig. 3-74 Disk Motor Revolution Detector Circuit

(4) PQS detector: This detects the tape start position while rewind or fast-forward by duty of the PB CTL pulse CTL pulse is applied to pin 14 of IC605 through the capacitor C611 and is wave-shaped by Q7 and then is converted to DC level through the integrator consisting of R17 and C613.
The obtained DC level varies corresponding to the CTL pulse duty.
This DC level is compared with reference voltage produced by R18 and R37 in Q8 to detect the CTL pulse duty.
The CTL pulse is recorded on the tape by 20% duty modulation while 10 sec from recording start position and after 10 sec, CTL pulse duty will be 50% modulation.
Therefore, DC level of the CTL pulse of which duty is 20% modulation will decrease and Q8 and Q9 will be turned on. Then, low potential will be output to indicate the programme start position.

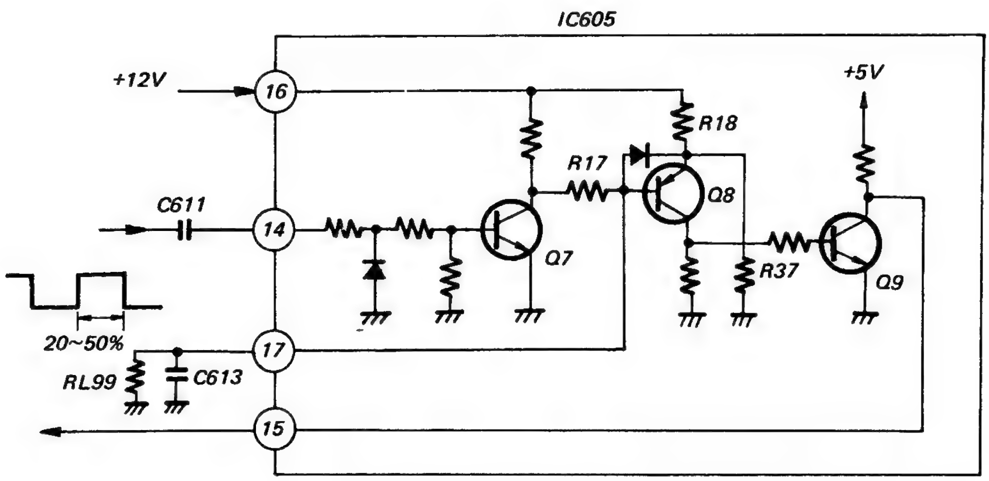


Fig. 3-75 PQS Detector

Key Sensing Matrix

The signals from the operating keys may be input to the microcomputer one by one. This input method, however, is not appropriate for the microcomputer because of too much number of inputs. In the present logic Control Circuit, the number of inputs to the microcomputer is reduced in a multiprocessing of key signals that the 4 bit scan signals output of the microcomputer and 8 bit signals input to it are connected 4 by 8 in a matrix fashion. A depressed operating key can be known by the microcomputer in the way that the high-level one of the eight input signals is detected at the time when one of the four scanning signals is present (see Fig. 3-76).

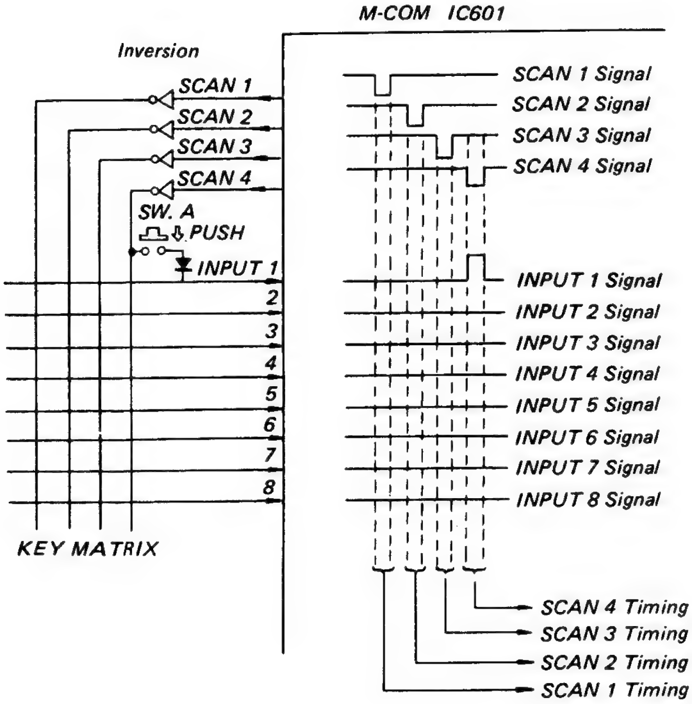


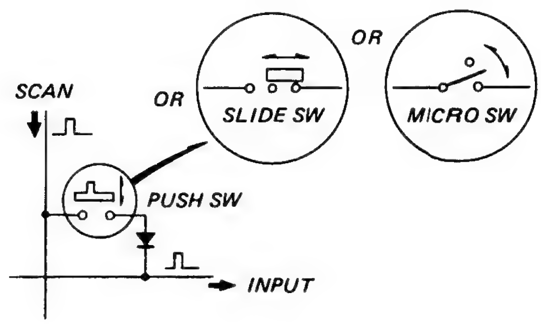
Fig. 3-76 Key Sensing Matrix

NOTE: If the switch A is depressed, for example, the input 1 signal goes to high at the time of the scanning 4 signal. The microcomputer, then, knows that the switch A was depressed.

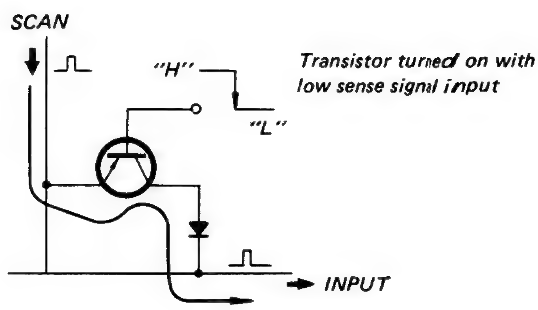
There are four types of devices for turning on or off the key sensing matrix scanning lines and input lines:

(1) Mechanical pushswitches, including the PLAY, REC, and other located on the front panel.
(2) Mechanical slide switches, including the AUTO REW switch SL15.
(3) Mechanical microswitches, including the cassette detect switch, recording INH switch, and others.
(4) Electronic switches, including the timer-controlled recording switch (ICL02).

Each of the electronic switches given in the last item (4) operates in the way, as illustrated in Fig. 3-77 (b), that the scanning signal is applied to the emitter of a PNP transistor and is allowed to flow through the collector when an active-low sense signal lowered the base potential enough to turns the transistor on.



(a) Mechanical switch



(b) Electronic switch

Fig. 3-77 Switches Used in Key Sensing Matrix

Mode Switching

Switching of the VTR body from one present mode of operation over to another mode is different in the priority depending on the both modes. Tables 3-4 and 3-5 show mode switching possible for one another in the control by the VCR body and Remote Control unit, respectively. Table 3-6 is mode switching possible by multipressing function keys (buttons). It should be noted that the Remote Control unit can switch over from the still state to the playback mode also by depressing the PLAY button and can switch over form the audio dubbing pause state to the playback mode by depressing only the PLAY button, while the VTR body has to have the PAUSE/STILL button depressed to reset the pause or still state.

Table 3-4 Possible Mode Switching on VTR Body

Preset mode / Switching mode	EJECT	REW	STOP	FF	PLAY	PAUSE	REC	AUDIO DUB	REVIEW	CUE
Only Cassette Holder Locked	O Backet up	X	X	X	X	X	X	X	X	X
In Loading	O Unloading	Δ	Δ	Δ	Δ	X	Δ	Δ	Δ	Δ
EJECT		□	□	□	□	X	□	□	□	□
REW	O		O	O	O	X	X	X	O	O
STOP	O	O		O	O	X	O	O	O	O
FF	O	O	O		O	X	X	X	O	O
PLAY	O	O	O	O		O (Still)	O	O	O	O
STILL	O	O	O	O	▨	O Pause reset)	O (Rec pause)	O (Dub pause)	O	O
REC	O	X	O	X	X (Note 1)	O (Rec pause)		X	X	X
REC PAUSE	O	X	O	X	X	O (Pause reset)	X	X	X	X
AUDIO DUB	O	O	O	O	O	O (Audio dub pause)	O		O	O
AUDIO DUB PAUSE	O	O	O	O	▨ O (Still)	O (Pause reset)	O (Rec pause)	X	O	O
REVIEW	O	O	O	O	O (Note 2)	X	X	X		O
CUE	O	O	O	O	O	X	X	X	O	

O Direct switching possible.
Δ Switching after end of loading.
□ Same as above after entering loading.
X Direct switching impossible.
▨ Different in mode switching between VTR body and Remote Control unit.

NOTES: 1. The playback mode can be set by the Remote Control unit.
2. The playback mode is set in place of the still state by the Remote Control unit.

Table 3-5 Possible Mode Switching by Remote Control

Preset Mode / Switching Mode	STOP	PLAY	PAUSE	RE-VIEW	CUE	Double Speed	SLOW
Only cassette holder	X	X	X	X	X	X	X
In Loading	Δ	Δ	X	Δ	Δ	Δ	X
EJECT	□	□	X	□	□	□	X
REW	O	O	X	O	O	O	X
STOP		O	X	O	O	O	X
FF	O	O	X	O	O	O	X
PLAY	O		O Still	O	O	O	O
STILL	O	O Pause Reset (Note 1)	O Pause Reset	O	O	O	O
REC	O	X	O Rec Pause	X	X	X	X
REC Pause	O	X	O Pause Reset	X	X	X	X
AUDIO DUB	O	O	O Audio Dub Pause	O	O	O	X
AUDIO DUB Pause	O	O Play (Note 2)	O Pause Reset	O	O	O	X
REVIEW	O	O	X		O	O	X
CUE	O	O	X	O		O	X
Double Speed	O	O	O Still	O	O		O

O Direct switching possible.
Δ Switching after end of loading.
□ Same as above after entering loading.
X Direct switching impossible.
▨ Different in mode switching between Remote Control unit and VCR body.

NOTES: 1. The playback mode cannot be set on the VCR body.
2. The still state is set on the VCR body.

Table 3-6 Mode Switching Priority in Multipressing Keys

Preset Mode	STOP	EJECT	REW	FF	PLAY	PAUSE	REC	AUDIO DUB	REVIEW	CUE	Double Speed
STOP		STOP	←	←	←	←	←	←	←	←	←
EJECT	STOP		EJECT	←	←	←	←	←	←	←	←
REW	STOP	EJECT		REW	←	←	←	←	←	←	←
FF	STOP	EJECT	REW		FF	←	←	←	REVIEW	FF	←
PLAY	STOP	EJECT	REW	FF		STILL	PLAY	←	REVIEW	PLAY	←
PAUSE	STOP	EJECT	REW	FF	STILL		REC PAUSE	AUDIO DUB PAUSE	REVIEW	CUE	Double Speed
REC	STOP	EJECT	REW	FF	PLAY	REC PAUSE		REC	REVIEW	CUE	Double Speed
AUDIO DUB	STOP	EJECT	REW	FF	PLAY	AUDIO DUB PAUSE	REC		REVIEW	CUE	Double Speed
REVIEW	STOP	EJECT	REW	REVIEW	←	←	←	←		←	←
CUE	STOP	EJECT	REW	FF	PLAY	CUE	←	←	REVIEW		CUE
Double Speed	STOP	EJECT	REW	FF	PLAY	Double Speed	←	←	REVIEW	CUE	

Plunger Solenoid Operations

1. Energization

The electronic logic circuits replace the mechanical logic devices in the previous models. For mechanical mode setting, therefore, the present Logic Control Circuit uses a variety of plunger solenoids. Table 3-7 shows the plunger solenoids which are energized in accordance with each mode of operation.

Table 3-7 Plunger Solenoid Energization for Respective Modes of Operation

Solenoid \ Mode	EJECT	REW	FF	PLAY	REC	AUDIO DUB	C (CUE)	R (REVIEW)	PAUSE	Double Speed	STILL	SLOW
EJECT SOLENOID	O											
REW SOLENOID		O						O				
FF SOLENOID			O				O					
PLAY SOLENOID Note 1				O	O	O			O	O	O	O
Q/R SOLENOID Note 2							O	O				
PINCH LOCK SOLENOID				O	O	O				O	O	O
PAUSE SOLENOID Note 3									O			

Marks O indicate energization.

NOTES:
1. The play solenoid is energized for approximately 0.5 sec to slacken tape to prevent sticking when the end of loading, fast forward, rewinding, CUE, or review is switched over to the stop state.
2. The cue/review solenoid is not energized for the fast cue or review, (super scanning) when holding the CUE or REVIEW button depressed.
3. The pause solenoid is energized for approximately 0.5 sec when the stop state is switched over to the recording or audio dubbing mode.

2. Plunger Solenoid Drive Circuits

The Logic Control Circuit uses two types of plunger solenoids: 2-end, 1-tapped solenoids including the eject, rewinding, fast-forward, play, cue/review, and pinch lock solenoids, and 2-end solenoid including the pause solenoid.

(1) Driving the 2-End, 1-Tapped Solenoid

Each of the 2-end, 1-tapped solenoids is energized in the way that the start tap is decreased for a moment to the low level to lower the impedance for allowing high current enough to attract the plunger. The start tap, then, is recovered to the original level to raise up the impedance, remaining a small current necessary to hold the plunger attracted.

The rewinding solenoid is taken for explanation as the typical solenoid (see Fig. 3-78). If the VCR is set into either of the rewinding or review mode, pin 7 on IC601 changes from the high level to low. This turns Q634 on, the collector of which steps up to 5 V. It is applied to C618 and pin 2 on IC604. The 5 V step-up voltage is differentiated through C618, RL71, and RL75. The differentiated pulse turns the Darlington amplifier, consisting of Q621 and Q627, on for a moment, approximately 50 msec.

The amplifier, then, decrease the start tap of the rewinding solenoid down to around 1 V for the moment. The impedance between the solenoid 12 V end and start tap is as low as the order of ohms. This allows a momentary current as high as approximately 1.6 A to flow the solenoid, which attracts the plunger.

On the other hand, the 5 V step-up voltage applied to pin 2 on IC604 makes the voltage at pin 15 decrease from 12 V to 1 V, which is connected to the hold end of the solenoid. The 1 V voltage allows the hold current to remain flowing through the solenoid even when the start tap rises from 1 V to 12 V. The solenoid, that is, holds the plunger extracted. Note that as the impedance between the solenoid 12 V and hold ends is around 60 Ω, the hold current is 180 to 200 mA.

Of the six 2-end, 1-tapped solenoids, the eject and play solenoids need a particularly high attractive force. The circuit is made to have start current duration as long as 100 msec. This is accomplished in the way that the differential time constant is made longer.

NOTE: D614 absorbs negative-going spicks due to differentiation. D621 and D630, also, absorb spikes due to the inductive load.

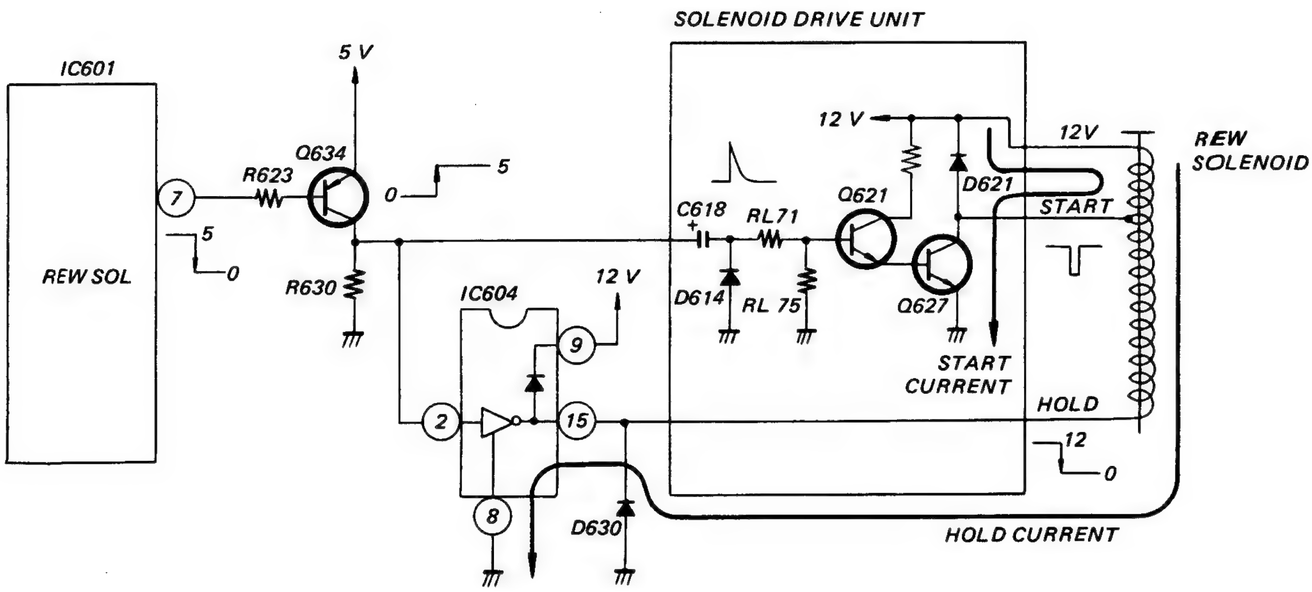


Fig. 3-78 Rewinding Solenoid Drive Circuit

3. Driving the Pause Solenoid (2-end Solenoid)

If the VCR is set into the pause state, the set signal is delayed a little by the timing adjustment feature (which is explained later) in IC602. It, then, lowers from 5 V to 0 V at pin 13 on. IC602. This turns Q636 on, which produces a 0 V-to-5 V step-up voltage at the collector. The step-up voltage is differentiated through C622, RL80, RL82. The differentiated pulse turns Q640 on for approximately 0.5 sec. The collector voltage of Q640 becomes to 1 V. It allows start current of approximately 1 A to flow through the pause solenoid as the impedance of the pause solenoid is around 10 Ω. The pause solenoid attracts the plunger. After the plunger has been fully attracted, the 5 V voltage at pin 6 on IC604 sets the voltage at pin 11 to 1 V. This allows the pause solenoid to have hold current of approximately 180 mA as 11 V is applied across the impdance of around 10 Ω itself plus the serial 47 Ω resistor.

Mode Setting Operation

1. Loading and Unloading Operations

(1) Loading

If the cassette detect switch is turned on, the voltage at pin 19 on IC601 goes to 0 V and that at pin 20 to 5 V. The former turns Q650 off, which sets the base voltage of Q647 and Q648 to 11.7 V. The latter turns Q619 off, which also turns Q651 off. This sets the base voltage of Q649 to 12 V. Q649, then, is turned off. The eject switch has the contacts 1 and 2 closed during loading. This allows the loading motor to have a voltage of approximately 11.0 V applied. Consequently, the loading current flows in the route of the +12 V line, the collector of Q647, the emitter of Q647, the loading motor, and the ground (see Fig. 3-80).

(2) Unloading (With EJECT Button Depressed)

If the EJECT button on the front Control Circuit board is depressed, this prompts the eject solenoid to be energized. The eject solenoid actuates the eject switch to close the contacts 1 and 3. The EJECT button, also, makes pins 19 and 20 on IC601 set to 2 V and 0 V, respectively. The 2 V voltage turns Q650 on, which sets the base of Q647 to 0 V and the base of Q648 to 0.5 V. Q647, then, is turned off and Q648 on. The 0 V voltage, on the other hand, turns Q619 on, which turns Q651 on. This, also, turns Q649 on, the collector of which goes to 11.9 V. Consequently, the loading motor has a voltage of approximately 10.7 V applied in the direction opposite to that of loading. The unloading current flows in the route of the +12 V line, the emitter of Q649, the collector of Q649, the loading motor, the emitter of Q648, the collector of Q648, and the ground. The unloading operation ends when the cassette detect switch is turned off (see Fig. 3-80). Table 3-8 shows major circuit voltages in loading and unloading operations.

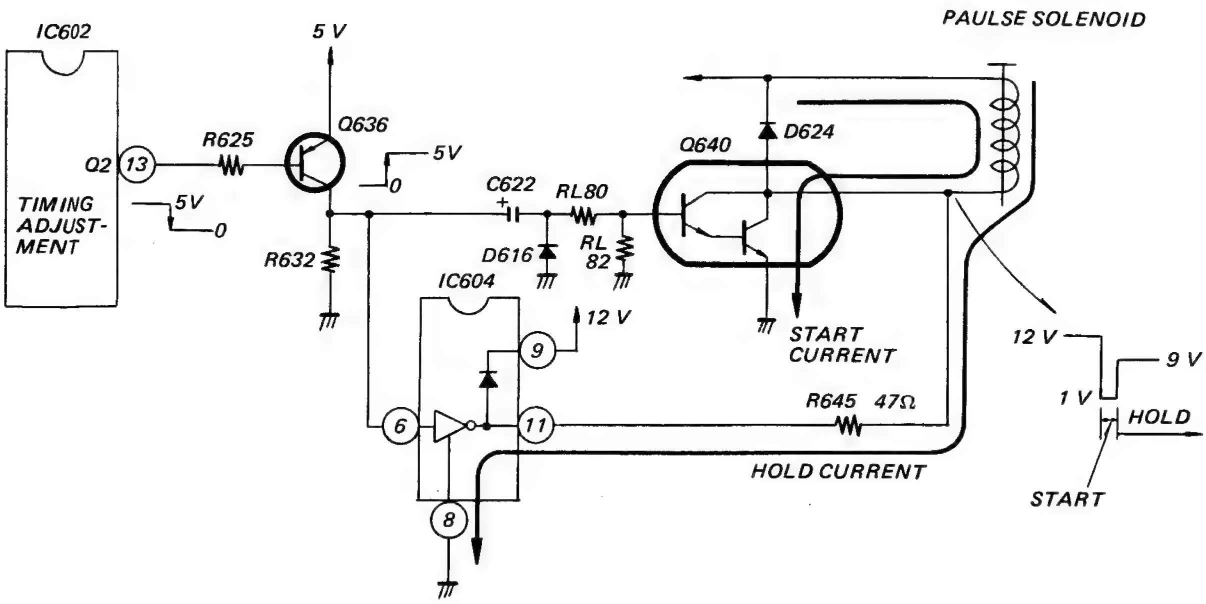
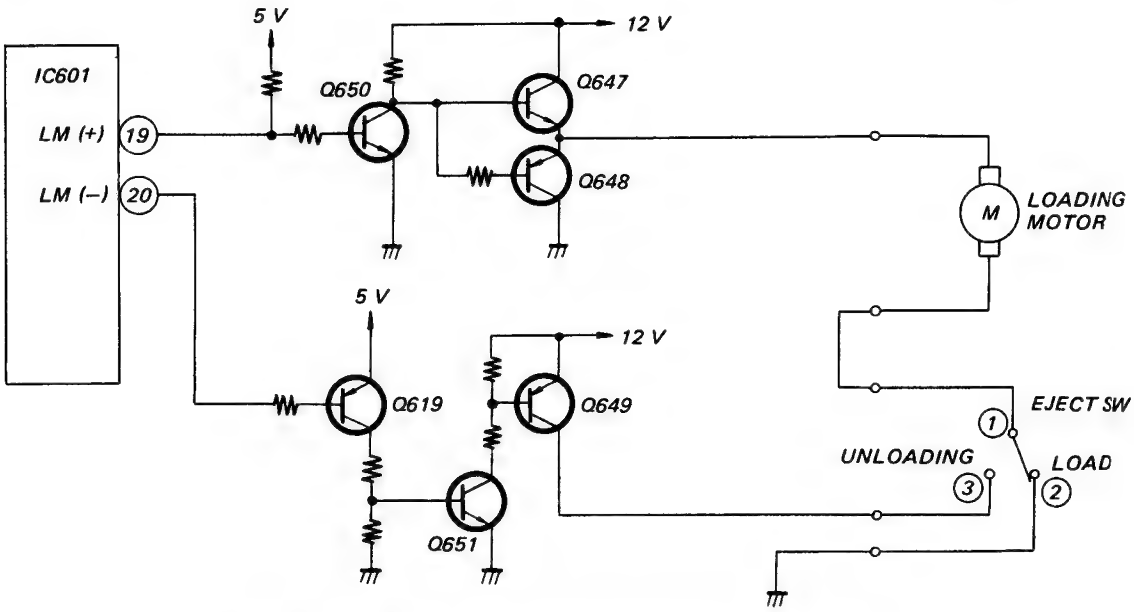


Fig. 3-79 Pause Solenoid Drive Circuit

Table 3-8 Major Circuit Voltage in Loading and Unloading Operations (in V)

	IC 601		Q647		Q648	Q651	Q649		EJECT SW	Loading Motor
	19	20	Base	Emitter	Base	Base	Base	Collector		
LOADING	0	5	11.7	11.0	11.7	0	12	0	1 and 2 OFF	+11.0
UNLOADING	2	0	0	1.2	0.5	0.7	11.3	11.9	1 and 3 ON	−10.7



NOTE: EJECT SW, which starts after eject solenoid energization as interlocked with eject solenoid.

Fig. 3-80 Loading Motor Drive Circuit

In addition, depressing the EJECT button prompts IC601 to feed from pins 26 through 29 the binary signals A through D encoded in accordance with Table 3-9. The encoded binary signals corresponding to the eject action are all at the low level (L). The binary code is decoded through ICL01, pin 1 of which goes to low. The low level makes the EJECT LED light DL01 illuminate. The low level, also, is connected via pin 6 on P601 to the base of Q638 to turn on. The collector of Q638, then, goes to 5 V. The 5 V voltage is connected via pin 3 on P612 to the start tap of the eject solenoid on the solenoid drive unit. A high current flows through the eject solenoid for a moment to extract the plunger. The 5 V voltage, also, is connected to pin 5 on IC604. Pin 12 on IC604 goes to approximately 1 V, which keeps the hold current flowing through the eject solenoid.

2. Stopping

When the VTR is reset to the stop state, the encoded binary signals A through D output of pins 26 through 29 on IC601 become all high (H). The decoder ICL01 provides no active operation. The solenoid and motor and associated circuits all do not operate; all the mechanisms are in the stop state. Any of the mode settings described in the following sections is generally switched over from the stop state.

Table 3-9 Operation Code

		D	C	B	A
IC601	ENCODE OUT PIN NO.	29	28	27	26
ICL01	DECODE IN PIN NO.	12	13	14	15
Mode	EJECT	L	L	L	L
	REW	L	L	L	H
	FF	L	L	H	L
	STILL	L	L	H	H
	–	L	H	L	L
	REC	L	H	L	H
	AUDIO DUB	L	H	H	L
	CUE (C)	L	H	H	H
	REVIEW (R)	H	L	L	L
	Double speed (REMOCON)	H	L	L	H
	–	H	L	H	L
	–	H	L	H	H
	–	H	H	L	L
	–	H	H	L	H
	–	H	H	H	L
	STOP or PLAY	H	H	H	H

3. Rewinding Mode Setting

When the REW button is depressed, IC601 outputs the code of binary signals corresponding to the rewinding mode (see Table 3-9) unless the rewinding tape sensor detects the beginning of tape. The encoded signal makes the level at pin 2 on ICL01 go low (L), which illuminates the REW LED light DL02. The low signal, also, is inverted through QL05. The inverted signal is fed as the fast-forward/rewind signal to the Servo Control Circuit.
Further, the encoded signal makes the level at pin 7 (REW SOL) on IC601 go low (L), which turns Q634 on. The collector voltage of Q634 goes to 5 V, which enables the rewinding solenoid to attract the plunger (see Fig. 3-78).

4. Fast-Forward Mode Setting

When the FF button is depressed, IC601 outputs the code of binary signals corresponding to the fast-forward mode (see Table 3-9) unless the fast-forward tape sensor detects the end of tape. The encoded signal makes the level at pin 3 on ICL01 go low (L), which illuminates the FF LED light DL04. The low signal, also, is inverted through QL05. The inverted signal is fed as the fast-forward/rewind signal to the Servo Control Circuit.
Further, the encoded signal makes the level at pin 8 (FF SOL) on IC601 go low, which turns Q635 on. The collector voltage of Q635 goes to 5 V, which allows a high current to flow for a moment form the +12 V line through the fast-forward solenoid to the start tap, Q622, Q628, and the ground.
On the other hand, the hold current flows from the +12 V line through the fast-forward solenoid to the hold end, pin 14 on IC604, and the ground. The fast-forward solenoid, then, is energized to attract and hold the plunger.

5. Recording Mode and Recording Pause State Setting

(1) Recording Mode Setting

When the REC button is depressed, the level at pin 17 on IC601 goes low (L) if the recording INH switch is off. The low signal allows the disk motor enable signal to be fed to the Servo Control Circuit. The level at pin 6 on IC601, in turn, goes low, which turns Q633 on. The collector voltage of Q633 goes to 5 V, which enables the play solenoid to attract and hold the plunger. The level at pin 9 on IC601, in turn, goes low, which makes the level at pin 5 on IC602 go low. This allows the level at pin 1 on IC602 to go low when the leading edge of the PG pulse comes as the clock to pin 3 on IC602. The low signal turns Q637 on. The collector voltage of Q637 goes to 5 V, which enables the pinch lock solenoid to attract and hold the plunger. This makes the pinch roller to be pressed to the capstan to feed tape.
In the recording mode setting, the base voltage of Q633 is raised up to 5 V. Otherwise, when Q658 is turned on in the rewinding mode with the rewinding sensor detecting the beginning of tape and with the play solenoid not energized for the high level at pin 6 on IC601, current flows into the base of Q658. This sets pin 6 on IC601 to unstable high level, which may turn Q633 on. Q633, then, misenergized the play solenoid.
Depressing the REC button prompts IC601 to output from pins 26 through 29 the code of binary signals corresponding to the recording mode (see Table 3-9). The encoded signal makes the level at pin 6 on ICL01 go low (L). The low signal makes the switch eliminating light DL03 and mode indicator light DL07 turn on. The low signal is connected from pin 1 on PL10 through pin on P601 to pin 8 on IC603.
Since pin 17 on IC601 is at the low level in recording, the level at pin 9 on IC603 goes low and the NOR gate output pin 10 on IC603 goes high. This turns Q643 on, which alos turns Q652 on. The collector voltage of Q652 goes to 12 V. The 12 V voltage is fed through P615 and P616 to the Audio Circuit and Video Circuit as the recording +B voltage.

(2) Recording Pause State Setting

When the PAUSE button is depressed during recording, the level at pin 13 (PAUSE LED) on IC601 goes low (L). This makes the PAUSE state indicator LED light DL05. The level at pin 9 (PINCH LOCK SOL) on IC601, in turn, changes from the low (L) level to high (H) and the one at pin 10 (PAUSE SOL) on IC601 changes from the high (H) level to low. These signals are synchronized with the PG pulse for timing adjustment by IC602. The level at pin 1 on IC602, then, changes from the low level to high and the one at pin 13 changes from the high level to low. Q637, also, changes from the "on" state to "off" and Q636 changes from the "off" state to "on". These release the pinch lock plunger and make the pause plunger be attracted and held in. Note that the pin 17 (DISK MOTOR) on IC601 remains at the low level. The disk motor keeps revolving.

6. Audio Dubbing Mode and Audio Dubbing Pause State Setting

(1) Audio Dubbing Mode Setting

When the AUDIO DUB button is depressed the level at pin 17 on IC601 goes low (L) if the recording INH switch is off. This allows the disk motor enable signal to be fed to the Servo Control Circuit. The level at pin 6 on IC601, in turn, goes low, which turns Q633 on. The collector of Q633 goes to 5 V. This enables the play solenoid to attract and hold in the plunger. The level at pin 9 on IC601, then, goes low and the one at pin 5 on IC602 goes low. This allows the level at pin 1 on IC602 to go low when the leading edge of the PG pulse comes as the clock to pin 3 on IC602. The low signal turns Q637 on. The collector voltage of Q637 goes to 5 V, which enables the pinch lock solenoid to attract and hold the plunger.

Depressing the AUDIO DUB button prompts IC601 to output from pins 26 through 29 the code of binary signals corresponding to the audio dubbing mode (see Table 3-9). The encoded signal makes the level at pin 7 on ICL01 go low. The low signal makes the light DL06 illuminate. The low signal, also, is connected from pin 2 on PL10 through pin 2 on P601 to pin 6 on IC603.

Since pin 17 (DISK MOTOR ON) on IC601 is at the low level in audio dubbing, the level at pin 5 on IC603 goes low and the NOR gate output pin 4 on IC603 goes high. This turns Q644 on, which also turns Q653 on. The collector voltage of Q653 goes to 12 V. The 12 V voltage is fed through pin 2 on P615 to the Audio Circuit as the audio dubbing +B voltage.

Since Q644 is on, its collector is at the low level. This decreases the base potential of Q654 through D635 to turn on. The collector voltage of Q654 goes to 12 V. The 12 V voltage is fed as the playback and audio dubbing +12 V voltage to the Servo Control Circuit and to the Video Circuit through pin 4 on P505.

(2) Audio Dubbing Pause State Setting

LED light illumination, solenoid energization, and disk motor revolving operations in the audio dubbing pause state setting, are similar to the ones in the recording pause state setting.

In the audio dubbing pause state setting, pin 13 on IC601 is at the low (L) level. This turns Q660 on. Pin 2 on P601 is also at the low level. This turns Q659 on. The collector level of Q659, then, is high. The high signal is fed to the Servo Control Circuit as the audio muting release signal.

7. Playback Mode and Still State Setting

(1) Playback Mode Setting

The playback mode setting operations is the same as the recording mode setting operation that the play solenoid and pinch lock solenoid are energized. When the PLAY button is depressed, the level at pin 12 on IC601 goes low (L). This illuminates the light DL09 through pin 2 of P604. Note that in the playback mode setting operation, IC601 does not output any active code of binary signals from pins 26 through 29, but the decoder ICL01 operates in the same way as in the stop state setting operation. The levels at pins 12 and 17 on IC601, also, go low. These make the levels at pins 1 and 2 on IC603 go low. These make the NOR gate output pin 3 go to the high (H) level. This high level turns Q645 on, which turns Q639 on. The collector voltage of Q639 becomes 12 V. The 12 V voltage is connected through pin 3 on P615 to the Audio Circuit as the playback signal. Since Q645 is on, its collector level is low. This decreases the base potential of Q654 through D634. The decreased base potential turns Q654 on. The collector voltage of Q654 goes to 12 V. The 12 V voltage is fed to the Servo Control Circuit as the playback and audio dubbing +12 V voltage and through pin 4 on P505 to the Video Circuit.

(2) Still State Setting

If the PAUSE/STILL button is depressed during playback, the VTR is set into the still state. The level at pin 13 on IC601, then, goes to the low level. The low level illuminates the STILL LED light DL05. Pins 26 through 29 on IC601 output the code of binary signals corresponding to the still state (see Table 3-9). The encoded signal makes the level at pin 4 on ICL01 go low (L). The low level turns QL04 on: The collector voltage of QL04 becomes high (H). The high signal is fed through pin 4 on PL10 and pin 4 on P601 to the Servo Control Circuit as the still state signal.

The still state setting operation is different from the recording pause state setting operation and the audio dubbing pause state setting operation in that the tape running by the capstan motor is stopped with leaving the pinch lock solenoid energized. The operation of the pause solenoid is the same as in the recording pause state setting operation or in the audio dubbing pause state setting operation.

8. Cue Mode Setting

When the CUE button is depressed, IC601 outputs from pins 26 through the code of binary signals corresponding to the cue mode (see Table 3-9). The encoded signal makes the level at pin 9 on ICL01 go low (L). The low level illuminates the CUE LED light DL10. The level at pin 8 on IC601, on the other hand, goes low. The low level turns Q635 on. This enables the fast-forward solenoid to attract and hold the plunger. The low level at pin 9 on ICL01 is connected through DL23 and pin 3 on PL10 and pin 3 on P601 to D607 and the base of Q632 as the cue and review signal (active low signal). The active low signal makes the level at pin 1 on IC603 go low. This turns Q632 on. Since the level at pin 17 on IC601 is low in the cue mode of operation, the level at pin 2 on IC603 also goes low. The level at pin 3 on IC603 becomes high. The following operation is similar to that of the playback mode setting operation. As a result, the play +12 V voltage is fed to the Audio Circuit and the playback and audio dubbing +12 V voltage to the Servo Control Circuit and Video Circuit.

On the other hand, since Q632 is on, its collector level is high. This allows C633 to keep charging current unless QL03 is turned on by holding the CUE button SL10 or REVIEW button SL08 depressed. The charging current turns Q656 off, which turns Q657 on. This enables the cue and review solenoid to attract and hold the plunger (see Fig. 3-81).

The disk motor enable signal is fed to the Servo Control Circuit with the level at pin 17 on IC601 being low. The cue and review signal, also, is fed to the Servo Control Circuit with the collector level of Q632 being high.

9. Review Mode Setting

When the REVIEW button is depressed, IC601 outputs from pins 26 through 29 the code of binary signals corresponding to the review mode (see Table 3-9). The encoded signal makes the level at pin 10 on ICL01 go low. The low signal illuminates the REVIEW LED light DL08. The level at pin 7 on IC601, on the other hand, goes low, which turns Q634 on. This enables the rewind solenoid to attract and hold the plunger. The low level at pin 10 on ICL01 passes DL24 and then is input to the OR circuit together with the review signal from DL23. The output of the OR circuit is applied to Q632. The following operation is similar to that of the cue mode setting operation. (see Fig. 3-81).

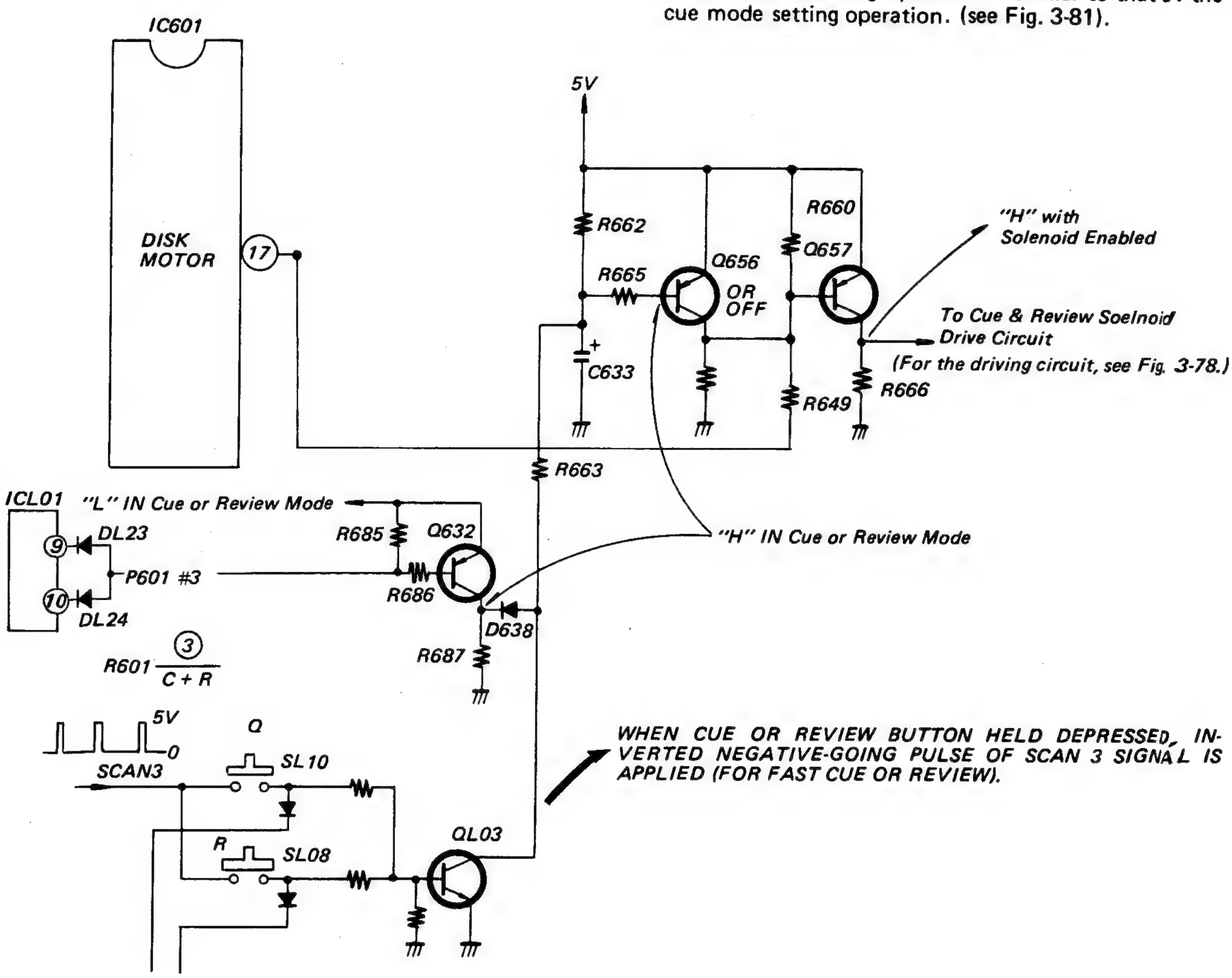


Fig. 3-81 Cue and Review Solenoid Drive Signal Circuit

10. Fast Cue and Review (Super Scan) Mode Setting
In the fast cue or review mode of operation, the picture can be played back as high as three times the normal cue or review playback, or as high as 20 times the ordinary playback, with holding the CUE or REVIEW button depressed. Setting the VTR in the fast cue or review mode deenergizes the cue and review solenoid which has attracted and held in the plunger. Fig. 2-64 illustrates the fast cue and review mode setting operation.
In the normal cue or review mode of operation, QL03 is off. The high collector level of Q632 is allowed to directly turn Q656 off. C633 is charged. If holding the CUE or REVIEW button depressed, on the other hand, the scan 3 pulse is applied directly to QL03. Only when the pulse is high, QL03 is turned on. The collector of QL03 goes to the low level. This discharges C633.
Then, we will consider about the time constants of charging and discharging of C633. In charging, current flows through R662 (20 kΩ) and R665 (20 kΩ) to C633. In discharging, current flows through R663 (200 Ω) from C633. The time constant of charging, thus, takes longer time than that of discharging. Consequently, the positive end of C633 cannot rise up to the high level. The result is that Q656 turns on. This turns Q657 off, which deenergizes the cue and review solenoid.

11. Double Speed Mode Setting (Only for Remote Control)
If the VTR is set in the double speed mode by the Remote Control unit, the code of binary signals corresponding to the double speed mode is output from pins 26 through 29 on IC601 (see Table 3-9). The encoded signal makes the level at pin 11 on ICL01 go low (L). The low signal illuminates the double speed LED light DL14. The low signal, also, is fed as the double speed signal through pin 5 on PL10 and pin 5 on P601 to the Servo Control Circuit. The low signal, further, passes D608 and then makes the level at pin 1 on IC603 go low.
The level at pin 12 on IC601 is high, which reverse-biases D611. The following operation is similar to that of the playback mode setting operation except that the PLAY LED light does not illuminate.

12. Antenna Switching
The antenna selector (TV-VTR selector) has two positions: TV and VTR, In the TV position, the level at pin 16 on IC601 is high; in the VTR position, it is low. In the VTR position, the TV-VTR LED indicator DL11 is lit through R608. The TV and VTR settings are alternated one after another whenever depressing the switch SL11. Note that when power is turned on, the selector is initially at the TV position. When any of the PLAY, AUDIO DUB, CUE, REVIEW, and Double Speed button is depressed, the selector is forcibly set to the VCR position.
In the VTR position, the level at pin 16 on IC601 is low. This turns Q646 off. The collector voltage of Q646 goes to approximately 11 V. This turns Q655 off. Therefore, Antenna select signal is connected through pin 3 on P605 to the Antenna Terminal board. The low signal, also, turns Q661 on. This allows the emitter of Q661 to feed the 9.5 V voltage to the modulator circuit as the power voltage.

13. Fault Detection Operation
(1) Tape End Sensor
If the end of tape is detected, pin 4 on IC605 goes to the low (L) level. The low level turns Q615 on. This allows the scan 2 signal to pass Q615 to the input pin 35. The microcomputer determines the signal as the tape end and then prompts the VCR to enter the stop state. If the auto-rewinding switch is on, then the VTR is switched over to the rewinding mode of operation.

(2) Tape Beginning Sensor
When the beginning of tape is detected, pin 18 on IC605 goes to the low (L) level. Since the level at pin 6 (PLAY SOL) on IC601 is high (H), however, Q658 is on. The low signal, therefore, turns Q616 on. This allows the scan 2 signal to pass Q616 to the input pin 34. The microcomputer determines the signal as the beginning of tape and then prompts the VTR to enter the stop state.
In the present logic control system, the rewind oscillator is forcibly stopped while the play solenoid is energized. This is done in the way that the low level at pin 6 on IC601 is connected through D609 to pin 21 IC605 to make this go low. The reason of forcibly stopping the rewind oscillator is to prevent possible heat resulting on the TV screen from the tape sensor oscillator with the rewind sensor placed in the physical vicinity ofthe pair of video heads.
As described previously, Q658 controls the output (pin 18 on IC605) of the rewind sensor. When the playback mode of operation is to be switched over to the rewinding mode, for example, the low signal at pin 18 on IC605 is to turn Q616 on directly. This leads to that the rewind oscillator is regarded to be not in operation. This inhibits the playback mode from being switched over to the rewind mode. To prevent such a wrong operation, Q658 arranged so that Q616 this is turned off and cannot be turned on by the low signal at pin 18 on IC605.

(3) Dew Sensor
If dew is detected, then pin 6 on IC605 goes to the high (H) level. The level at pin 12 on IC603, then, goes high. The high level holds the level at pin 11 on IC603 low at all times irrespective of the level at pin 13. The low signal is input to pin 5 on IC601 for switching over to the stop state.

(4) Slack Sensor

If some tape slack is detected, a 5 V voltage is connected to pin 1 on P608. The voltage makes the level at pin 13 on IC603 to go high (H). The high level holds the level at pin 11 on IC603 low at all times irrespective of the level at pin 12. The low signal is input to pin 5 on IC601 for switching over to the stop state.

(5) Disk Motor Revolution Sensor

If the disk motor fails to revolve with some cause, pin 10 on IC605 has no switching pulse. Pin 12 on IC605, then, goes to the low level. The low level is connected to pin 3 on IC601 for switching over to the stop state.

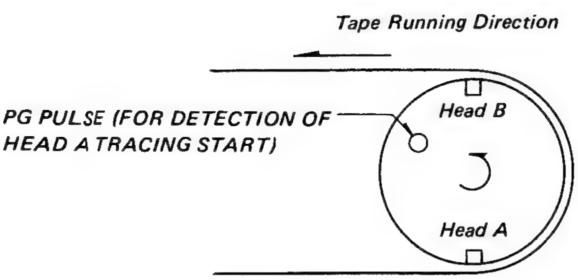
Timing Adjustment Circuit

(1) General

The timing adjustment circuit used in the present logic control system is provided for synchronizing the instants of setting and resetting the VTR into the pause state or the instants of energizing and deenergizing the pause solenoid and pinch lock solenoid, with the PG pulse. Such a synchronization assures that the train of control pulses can be recorded in a regular form. The regular train prevents tracing disturbance of the pair of video heads in the vicinity of a spliced portion of tape in an edition recording with use of the pause function, thereby maintaining uniform reproduced picture.

(2) Principles of Operation

For ease of explanation, assume that the PG pulse be generated when the head A is to start tracing, or the head B is to finish tracing, as illustrated in Fig. 3-82.



Note: The PG pulse is generated when the head A starts tracing.

Fig. 3-82 PG Pulse Generation

If the pause state set and reset instants are made at the same PAUSE button on-off instants, either head A or B is in the final tracing upon setting for the pause state. Either head A or B, also, is in the first tracing upon resetting from the pause state. The tracing head, further, is at any position on the tape pattern upon setting for or resetting from the pause state. The heads, thus, trace on the tape as illustrated in Fig. 3-83 (1) and (2). It could occur that in playback, the heads A and B cannot regularly alternated one after another in the tracing order. In such an event, noise could appear on the reproduced picture in the vicinity of the pause spliced portion. The new timing adjustment circuit adjusts the pause state set and reset instants to the head A tracing start instant, or the head B tracing finish instant, at any time. This means that the heads A and B can be alternated one after another in the regular tracing order at any time.

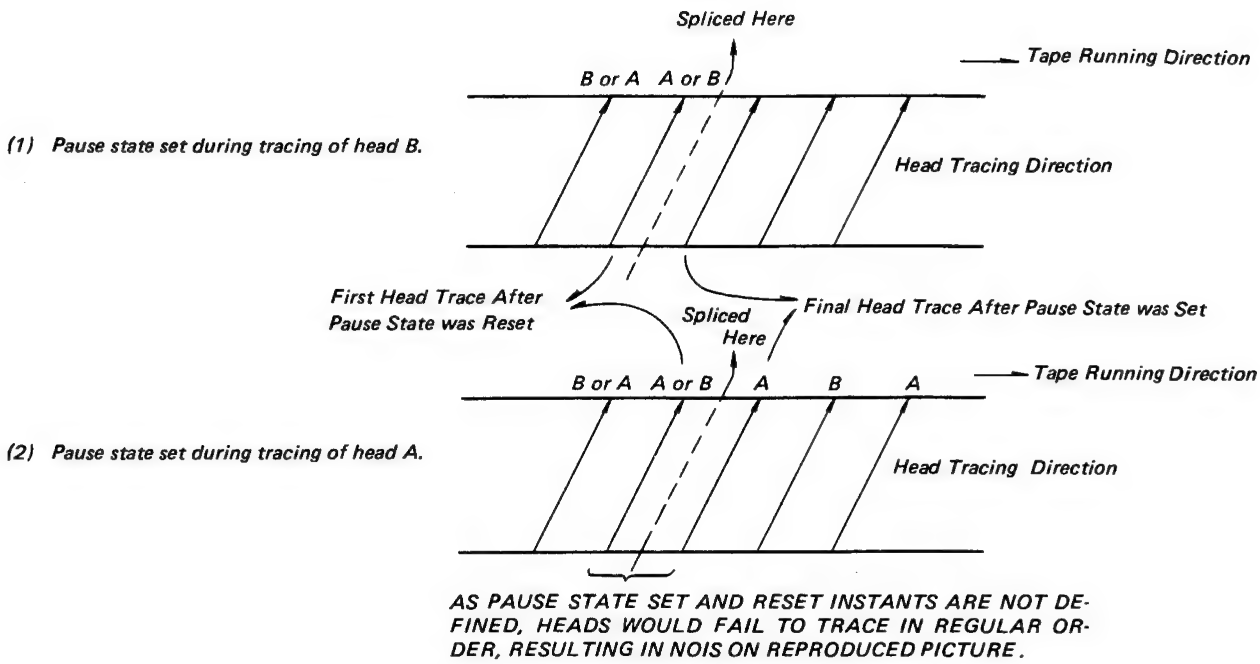


Fig. 3-83 Illustrative Head Tracing Pattern of Previous Splicing Recording Fashion

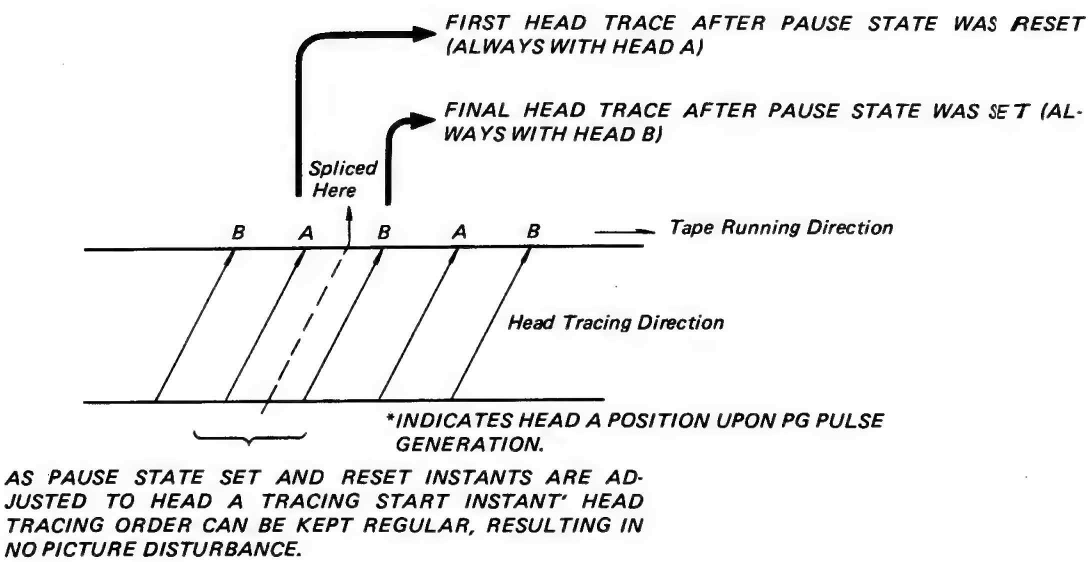


Fig. 3-84 Illustrative Head Trace Pattern of New Timing Adjustment Circuit

Table 3-10 Advantages of Timing Adjustment Circuit Compared with Previous Arrangement

	Previous Arrangement	New Timing Adjustment Circuit
Final Tracing Head Pause State Set	Either A or B	Always B
First Tracing Head Upon Pause State Reset	Either A or B	Always A
Head Position Upon Pause State Set or Reset	Not defined	Lower tape edge (marked with * in Fig. 3-84)

(3) Circuit Operation

Upon setting the pause state for which the pinch lock solenoid is deenergized and the pause solenoid is energized, logical state changes are as follows.
LOW at IC601 pin 9 to HIGH for IC602 pin 5.
HIGH at IC601 pin 10 to LOW for IC602 pin 9.
The leading edge of the PG pulse delivered from the collector of Q642 changes:
LOW at IC602 pin 1 to HIGH, which deenergizes the pinch lock solenoid.
HIGH at IC602 pin 13 to LOW, which energizes the pause solenoid.

Upon resetting the pause state for which the pinch lock solenoid is energized and the pause solenoid is deenergized, logical state changes are as follows.
HIGH at IC601 pin 9 to LOW for IC602 pin 5.
LOW at IC601 pin 10 to HIGH for IC602 pin 9.
The leading edge of the PG pulse delivered from the collector of Q642 changes:
HIGH at IC602 pin 1 to LOW, which energizes the pinch lock solenoid.
LOW at IC602 pin 13 to HIGH, which deenergizes the pause solenoid.

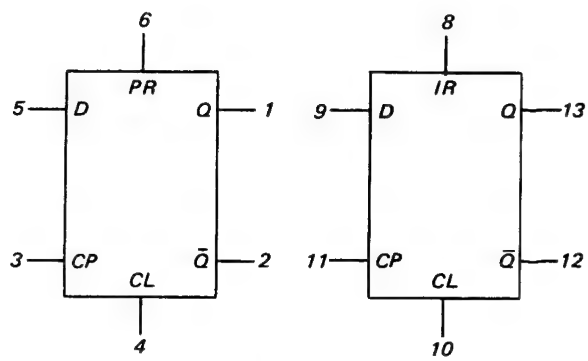
The resistor R646 initializes Q1 and Q2 to the high state when power is turned on. In the event the PG pulse will not come in with some cause when the pinch lock solenoid or pause solenoid needs to be deenergized, then the level at pin 9 on IC601 is made high through D633, or the level at pin 10 on IC601 is made high through D636. The high signal makes PR1 or PR2 high, thereby deenergizing the pinch lock solenoid or pause solenoid.

Upon setting the pause state, there is a timing difference of approximately 9 μsec between the instant when the low level at pin 9 on Q601 changes high and the instant when the high and the instant when the high level at pin 10 on IC601 changes low. The timing difference is due to the software programming time because of different ports. The timing difference could cause presetting, which results in deenergization of the pinch lock solenoid before the leading edge of the clock. To avoid such a failure, C624 is provided to absorb the spike. Fig. 3-86 is an operation time chart for the timing adjustment circuit.

Table 3-11 TC4013BP Truth Table

INPUTS				OUTPUTS	
CL	PR	D	CP Δ	Qn + 1	Qn + 1
L	H	∺	∺	H	L
H	L	∺	∺	L	H
H	H	∺	∺	L	H
L	L	L	↑	L	H
L	L	H	↑	H	L
L	L	∺	↑	Qn *	Qn *

∺ : Don't Care
Δ : Level Change
* : No Change



V_{DD}: 14, V_{SS}: 7

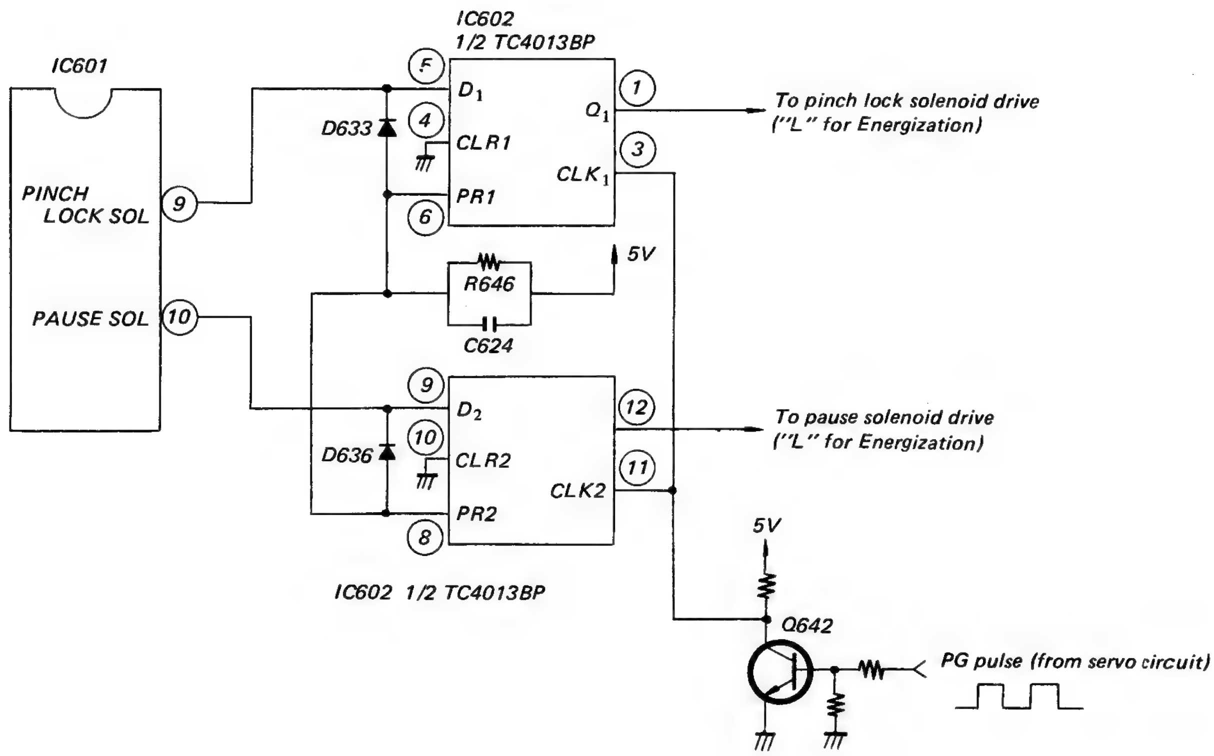


Fig. 3-85 Timing Adjustment Circuit

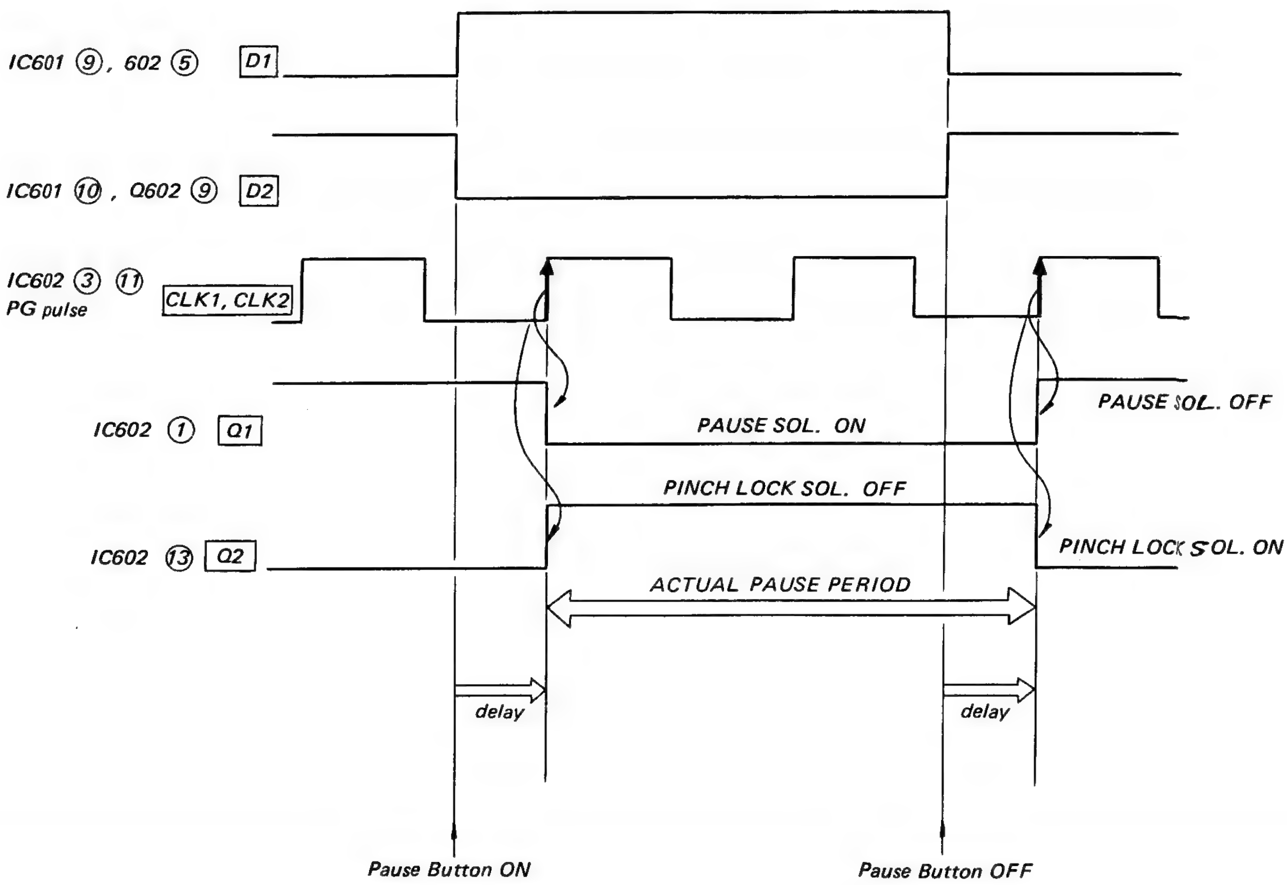


Fig. 3-86 Timing Adjustment Circuit Operation Chart

REMOTE CONTROL SYSTEM

1. General

For use of the Remote Control System, the VC-86 or VC-87 of the Control Unit is the wired remote control which is used to control the VTR remotely. The VC-86 or VC-87 is capable of remotely controlling 7 modes of operation: playback, cue, review, pause, double speed, SLOW and stop.

2. Circuit Description

A signal fed from the VC-86 is converted by ICR01 to a form acceptable input to the microcomputer ICL01 in the Logic Control unit, ICR01 (TC4532BP) is the 3-bit encoder that receives eight input signals, detects the signal of the highest level from among the eight signals, and outputs the corresponding signal in bits.

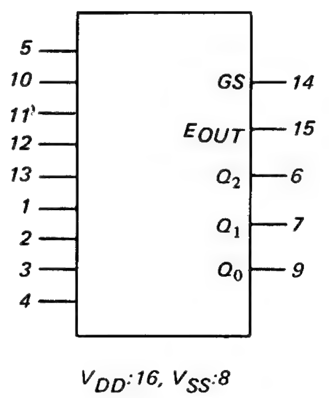


Fig. 3-87 ICR01 TC4532BP or CD4532BE Block Diagram

The output signal of ICR01 is inverted through the NOR gate in ICR02. The inverted signal is fed to the Logic Control Circuit.

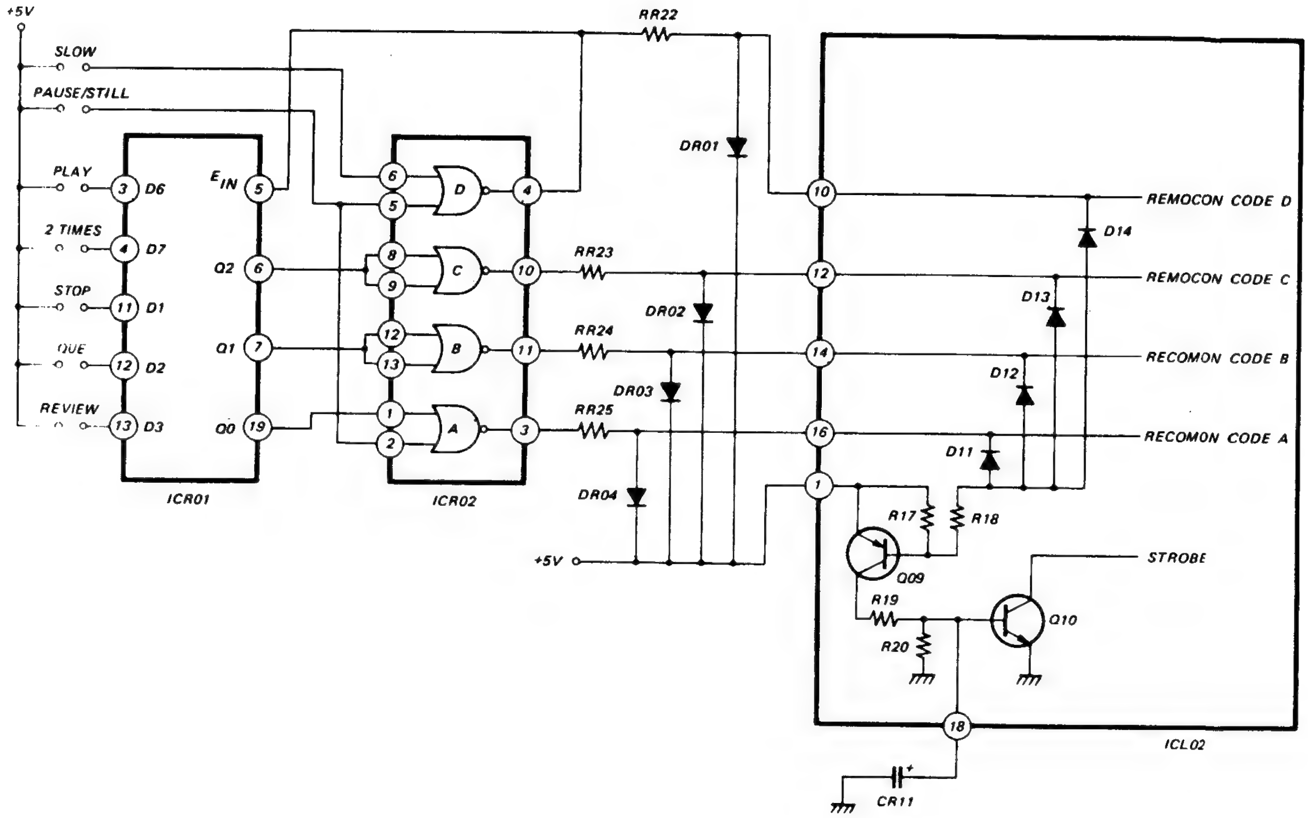
If the PLAY, CUE, REVIEW, DOUBLE SPEED, or STOP button on the VC-86 are depressed, the corresponding signal is input to the ICR01, which feeds out out the high-level signal from pin 14 (GS) irrespective of the kind of input signal. The output signal at pin 14 is used for judging whether the input signal is present or absent, ICR01, on the other hand, feeds out binary signals corresponding to the input signals from pin 9 (Q0), pin 7 (Q1), and pin 6 (Q2). Those output binary signals are inverted through the NOR gates A, B, and C, respectively. The inverted signals consist of the remote control signals, which are transmitted to the electronic Logic Circuit.

If the PAUSE button is pressed, the pause operation signal is inverted through the NOR gate D to the low-level (0 V). The inverted low-level signal is applied to pin 5 (E_{IN}). This prompts ICR01 to set all outputs to the low level. Instead, the pause operation signal is input to the NOR gates A and D, which form a binary signal for the pause mode of operation.

Table 3-12 Truth Table

INPUT									OUTPUT				
E_{IN}	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	GS	Q_2	Q_1	Q_0	E_{OUT}
L	∺	∺	∺	∺	∺	∺	∺	∺	L	L	L	L	L
H	L	L	L	L	L	L	L	L	L	L	L	L	H
H	H	∺	∺	∺	∺	∺	∺	∺	H	H	H	H	L
H	L	H	∺	∺	∺	∺	∺	∺	H	H	H	L	L
H	L	L	H	∺	∺	∺	∺	∺	H	H	L	H	L
H	L	L	L	H	∺	∺	∺	∺	H	H	L	L	L
H	L	L	L	L	H	∺	∺	∺	H	L	H	H	L
H	L	L	L	L	L	H	∺	∺	H	L	H	L	L
H	L	L	L	L	L	L	H	∺	H	L	L	H	L
H	L	L	L	L	L	L	L	H	H	L	L	L	L

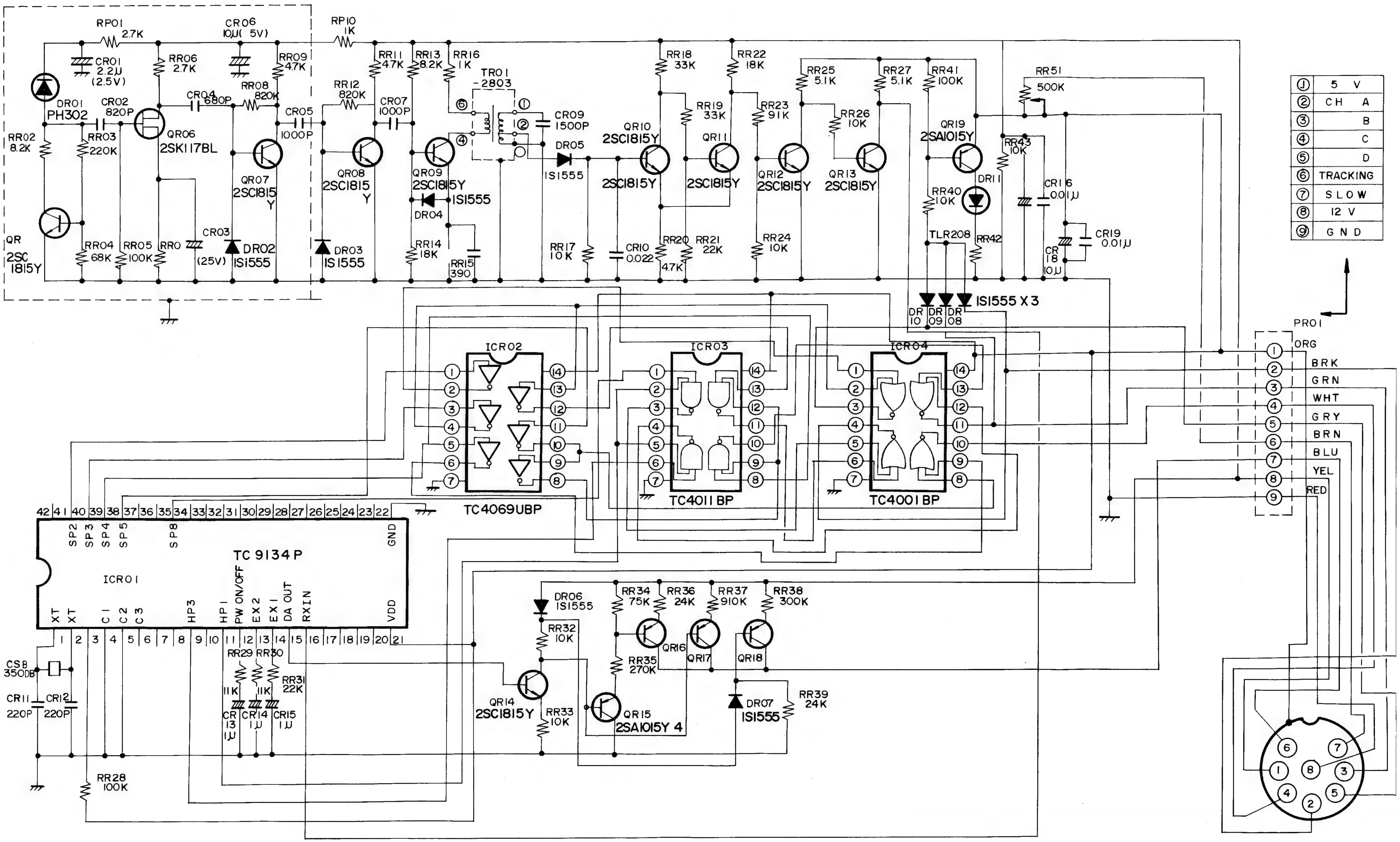
∺ Don't Care



INPUT	REMOCON CODE			
	A	B	C	D
PAUSE	L	H	H	L
PLAY	H	L	L	H
DOUBLE SPEED	L	L	L	H
STOP	L	H	H	H
CUE	H	L	H	H
REVIEW	L	L	H	H
SLOW	H	H	H	L

Fig. 3-88 Remocon Circuit

In the figure, QR09 and QR10 produce the strobe signal which is delayed by approximately 20 msec after an operation button on the VC-86. VTR Control Unit has been pressed. The strobe signal, then, prompts the micro-computer IC601 in the electronic Logic Control Circuit to read the input remote control signal, which controls the VTR operation.
Resistors of RR22 through RR25 and Diodes of DR01 through DR04 comprise of protection circuit to prevent impulses.



①	5 V
②	CH A
③	B
④	C
⑤	D
⑥	TRACKING
⑦	SLOW
⑧	12 V
⑨	GND

WIRELESS REMOTE CONTROL SECTION

(1) General

This remote controller is developed mainly to control the special playback operation.
The infrared ray which has been PCM modulated corresponding to the pressed button on the transmitter is fed from the transmitter ot the receiver.
The applied PCM signal is detected and wave shaped in the receiver and then, 4 bit coded signal corresponding to the PCM signal is produced in the IC installed in the receiver. This 4 bit coded signal is fed to the Logic circuit to control the operation.

(2) Specification

1. Model Name VC-87: Transmitter VC-87T
   Receiver VC-87R
2. Dimension
   Transmitter: 65(W) x 130(H) x 13(D)
   Receiver: 30(W) x 104(H) x 150(D), without DIN cord
   Unit: mm
3. Transmittion system Infrared ray PCM system
   λ = 950nm
   Main parts: Transmittion IC TC9132P
   Receiver IC TC9134P
   Diode (Transmittion)
   LD271 x 2
   Receiver PH302
   Clock Frequency: 350KHz
   Subcarrier: 29.17KHz
   Transmittion code: 16 bit serial/word
   1 command period 46msec
   1 command delay 16msec
   (after pressing key)
4. Output of receiver *4 bit binary code output
   *1 analogue output
   (PNP open collector)
5. Code corresponding to the mode

MODE	A B C D
*PLAY (Displayed)	H L L H
*2 Times (ditto)	L L L H
*CUE (continuous display)	H L H H
*REVIEW (ditto)	L L H H
*STOP (displayed)	L H H H
*SLOW (ditto)	H H H L
*SLOW UP (–)	–
*SLOW DOWN (–)	–

6. Receiver RED LED 5(W) x 2(H)
7. Distance for Transmittion
   10m with angle ±0, (MIN 7m), allowance angle ±30
8. Temperature Operating: –10C to 50C
   Strage: –20C to 70C
9. Vibration proof JIS C5025 match TEST I A type from 50 cm high dropping
10. Insulation DC 100V more than 50M ohms
    AC 150V for 1 minute only
11. Power consamption
    Transmitter: oxygenate silver battery SR44 x 3
    Receiver: +5V ± 10% 90mW
    +11.3V ± 10% 110mW
12. Weight
    VC-87T (Transmitter): NET 70g contained batteries
    VC-87R (Receiver): NET 250g
    VC-87: Gross 400g with packing
13. Others
    Connection cord: 8 pins DIN cord with plug
    Inatllstion tape: 16(W) x 69(L)
    Packing: VC-87T Vinyle bag
    VC-87R Vinyle bag
    VC87 Carton box
    attached owner's manual
14. Static electric shock proof
    DC 10KV

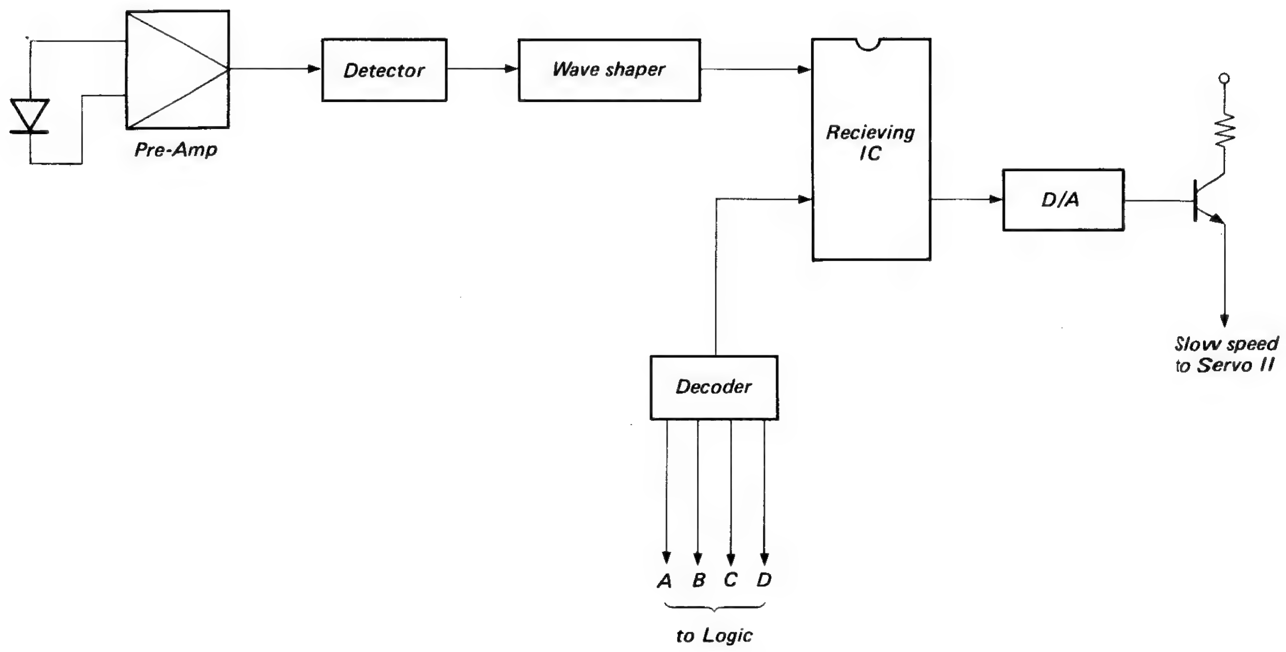
(3) Description

3-1 Transmitter section

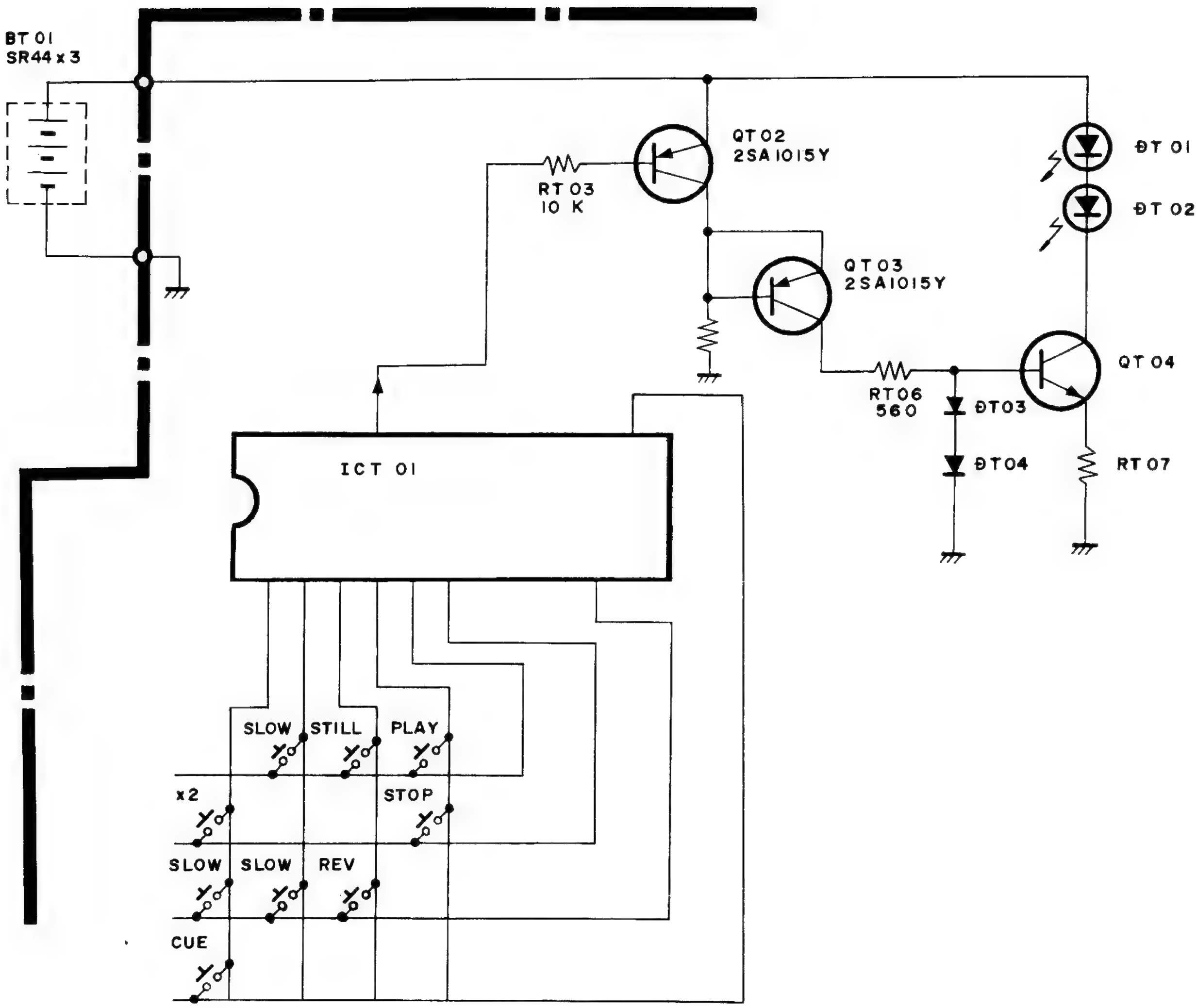
When the key button is pressed, IC01 detects the position of the pressed key and outputs the PCM signal corresponding to the position of the pressed key to the drive circuit section.
The drive circuit turns on or off QT04 according to the input PCM signal and the infrared ray modulated by the PCM signal is output from the infrared LED DT01 and DT02.
The oxygenate silver battery is used for power supply to keep the voltage constantly and QT04 is controlled as a constant current amplifier to improve the flactuation of the infrared ray.
The output code from the transmitter is shown in the figuer 2. It is used 3 pulses of the code bit to prevent the interferences. The transmitter has 2 mode commands which are only one command and continuous command.
While pressing CUE, REVIEW, SLOW UP (△) or SLOW DOWN (▽) button on the transmitter, the continuous command is output to the receiver. Therefore, while pressing CUE or REVIEW button, the picture movement will advance so quickly for a super scan operation. On the other hand, while pressing SLOW UP or SLOW DOWN button, the picture will advance at 1/3 to 1/30 times normal speed continuously. Therefore, the picture movement will be fixed at the speed where the button is released.
This IC IC01 drives the oscillation and drive circuits when the button is pressed only to improve the power consamption of the battery.

3-2 Receiver section

The transmitted PCM infrared ray is amplified and detected in the LED section, and is input to the IC through the waveshaper section. As the amplifier section has a high gain, it is covered with the shield cases to prevent the interferences.
First, IC detects 3 pulses of code bit which is 16 bit serial data and compares detected pulses with the reference code which has been set in the IC.
Then, if the detected pulses of code data are matched for the reference codes, IC receives the next incoming 5 bit data.
If the detected code is not matched for the reference one, IC cannot function. The input 5 bit data is converted to the parallel 4 bit data in the decorder section and is output to the logic circuit for the operation. While pressing SLOW UP or SLOW DOWN button, the detected 5 bit data signal varies the internal resistence of the transistor through the D/A converter to output to the SERVO circuit to control the picture movement slowly.

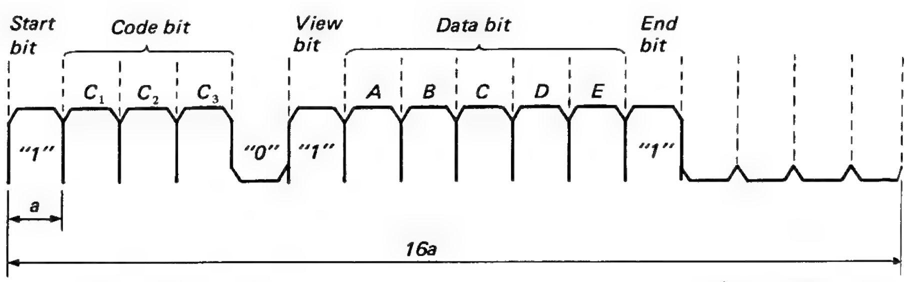


Receiver block diagram



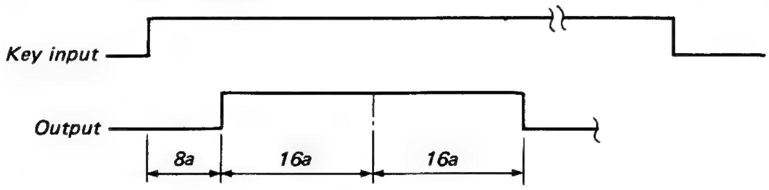
Output code from transmitter

Basic waveform (1 word)

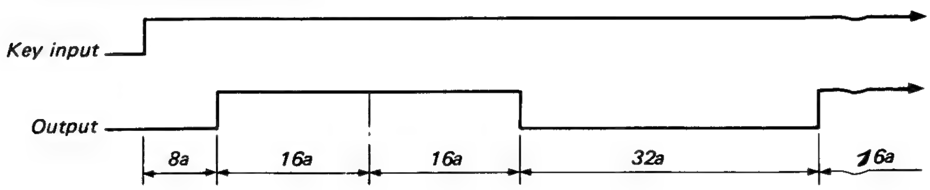


* $a = 1/f_{osc} \times 1024$ (52c) = 2.93 msec.

i) One command mode



ii) Continuous command mode



3-6 AUDIO CIRCUIT

The audio circuit is provided in PC Board SN7019 1550 and is a monaural circuit provided with a newly developed beta noise reduction IC.
This block is composed principally of the playback pre-amp, microphone amp, electronic switch, ALC circuit, bias oscillation circuit, βNR circuit, line output amp and the receiver output amp.

1. GENERAL

Input Circuit
To changeover the TV line input, set the input change-over switch to TV and the input will then be from the tuner built into the VTR. If the changeover switch is set to LINE, it will be connected to the AUDIO INPUT terminal (standard level −10dBs) on the front panel and will be fed to the audio circuit. If a microphone is inserted into the mike jack at the front, the mike will be connected regardless of the changeover switch (mike level −70dBs, 4.7K Ohms). Therefore, when not using the mike, it should always be pulled from the jack.

Audio Head Changeover Switch (Eelectronic Switch) (Q703, Q706, Q707, Q708)
Q703, Q706, Q707 and Q708 are for changeover of the audio head and are normally in playback state. Q703 is OFF, Q706, Q707, and Q708 are all ON and the head is connected to the input of the playback amplifier. During recording and nonrecording periods, a recording +B voltage is impressed on Q703 and Q708 turning Q703 ON and Q708 OFF. Q706 and Q707 therefore go OFF and the bias oscillator circuit and recording amplifier output will be connected to the head.

Playback Pre-amplifier (Q704, Q705)
Low noise and high gain are realized by using a combination of the low noise transistor Q704 and the low noise high gain field-effect transistor Q705.

Playback Compesnation Circuit (C706, C708, R751, R715, R716, C702, R705)
The feedback elements (C706, R715, R175) of the playback pre-amplifier maintains a falling characteristic from the low range (approx. 50 Hz) to the medium range (approx. 500 Hz) by varying the impedance by means of the frequency, and can maintain the high range characteristics with a peak in the neighborhood of approx. 10 kHz by means of C702 and R705 connected between R708, R716 and the base and collector of Q704.
Level adjustments can be carried out from the medium to high range by means of R751.

Playback Level Adjustment (R752)
The playback pre-amp output is fed to Pin 14 of IC702 after being level adjusted by R752.

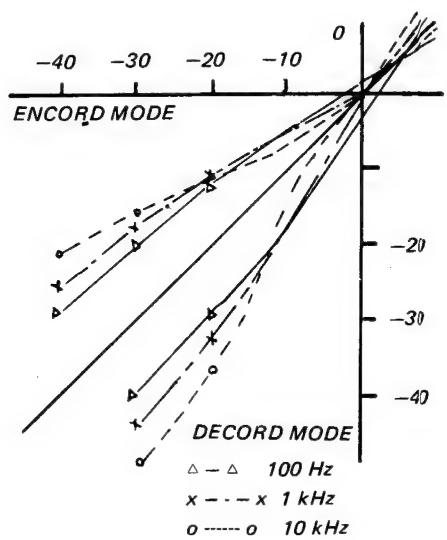
Mic. Amp. (IC701)
The Mic. pre-amp is composed of IC Input Pin 2, negative feedback Pin 3 and output Pin 6. This is a flat amplifier with a gain of 55dB.

Mic. and Line Switch (Q711, Q712, Q713)
When the mic. plug is inserted in the mic. jack, the +B of the mic. will be impressed on the audio unit and Q712 will go ON and the line input will be muted. On one hand, Q711 will function and, Q712, which held the mic. amp output in mute condition, will go OFF and the mic. amp output will be connected to the line input. When the mic. plug is pulled, this will be switched to the line input side.

2. BETA NOISE REDUCTION CIRCUIT

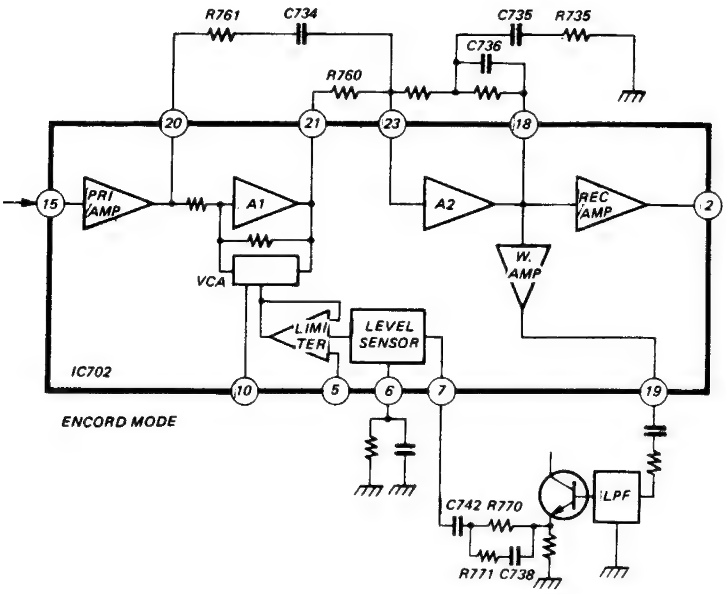
IC702 is a newly developed noise reduction (NR) IC and it is composed principally of the NR circuit, output amplifier circuit, recording amplifier circuit, receiver/playback switch circuit, NR ON/OFF circuit and the muting circuit.

General Outline
As this is a geometric combination of a uniformally controlled compression and expansion and variable emphasis throughout the entire range, the D range of the input signal is compressed when recording and this is expanded during playback. That is, this is a system in which an apparent D range is expanded and the input output characteristics are as shown in the Figure below.



The lower the input signal level during encording and the higher the frequency the higher the compression with corresponding increase in signal level. Also, the higher the level, the smaller the compression will become and recording will be carried out when the level becomes the same as the input signal level.
The lower the playback input signal during decoding and moreover, the higher the freuqency, the greater the expansion and the signal level will decrease. Also, the higher the level the smaller the expansion and signals of the same level as the input signal will appear at the output. Improvements of S/N ratio exceeding 10dB can be realized by this operation.

During Encord (REC. Mode)
IC702 and peripheral circuits are composed of the circuits shown in the Figure below.



Pre-Amplifier
The input signal enters Pin 15 of IC702 and, after being amplified approximately 20dB in the pre-amp, it appears as an output at Pin 20.

VRA
The higher the level of the input signal entering the VCA (Voltage Controlled Amplifier) connected between Pin 20 and Pin 21 and the VRA (Variable Response Amplifier) composed of R761, C734 and R760, the grater the compression in the high range. At the medium and low level, compressive action is carried out to comply with a primary linear line and the signal then enters the pre-emphasis circuit from Pin 23.

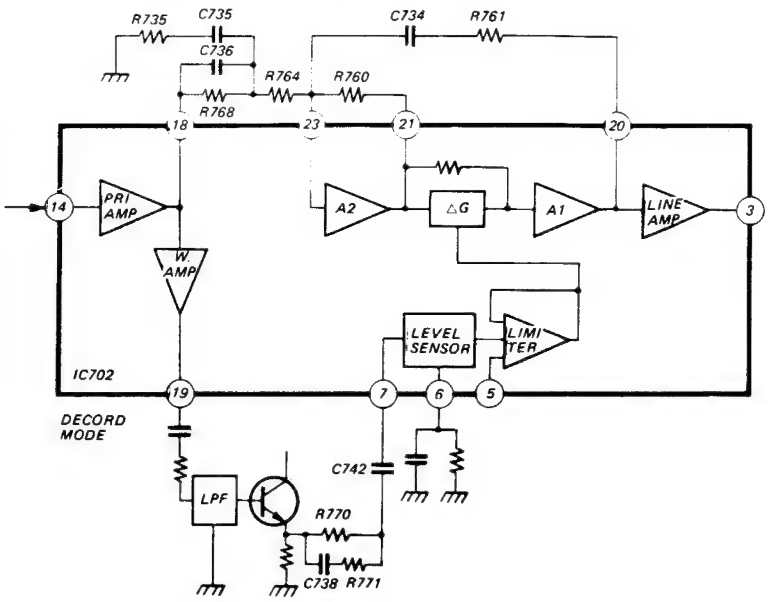
Fixed Pre-Emphasis Circuit
The signal entering Pin 23 forms a pre-emphasis circuit with amplifier A_2 and R764, R768, C736, C735 and R735 in Pins 18 and also with Pin 23 to raise the high region.

Waiting Circuit
To prevent easy saturation of the high region, the level sensor sensitivity is improved by providing a waiting amplifier and R770, C738, R771 and C742. Furthermore, with a low pass filter, signals from approx. 15.6 kHz enter the level sensor circuit to sufficiently mute the VRA to prevent malfunctions.

Level Sensor Circuit
Selects signal levels and, when level variation is high, functions near peak detection. When level variation is small, it functions near the actual value.

Limiter Circuit
Left limit circuit reduces variations of the level sensor output in the high region when at high level. The output of the limiter circuit is supplied to the VCA to control the VRA.

3 DURING DECORD (PLAY MODE)
IC702 and peripheral circuits are composed of the circuits shown in the Figure below.



Pre-Amp
The input signal during playback enters Pin 14 of IC702 and, after beino amplified approximately 20dB, is fed to Pin 18.

De-emphasis Circuit
The de-emphasis circuit formed by R735, C735, C736, R768 and R764 connected between Pins 18 and 23 lowers the high region. This circuit possesses characteristics opposite to the pre-emphasis circuit during encording.

VRA
This is formed between Pins 23 and 20 and expansion ratio in the high region appears to be higher as the input signal level becomes higher. Moreover, expansion operation at the medium and low levels follow a linear line. The signals compressed during encording return to their original state and enter the line amplifier to appear as outputs at Pin 3.

The waiting circuit, level anchor circuit and limiter ciruit operate the same as during encording.

4. MUTING CIRCUIT (Q710, IC702)
When a muting voltage is applied to R794 connected to the base of Q710, the collector and emitter of Q710 turns on and the voltage on Pin 24 of IC702 drops to "0" and the encording amplifier in IC702 and the output amplifier are muted. Muting is also carried out for several seconds during the play mode and when the power switch is set to ON or OFF to further reduce noise.

5. REC/PLAY SWITCH (Q717)
The unit will be in play mode when the PLAY +B is impressed on R762 connected to the base of Q717 causing Q717 to go OFF and removing the voltage of Pin 16 of IC702. When the PLAY +B is removed from the base of Q717, it will go ON causing voltage to be impressed on Pin 16 of IC702 again and putting the unit in REC. mode.

6. **βNR IN/OUT (IC702)**
Dropping Pin 17 of IC702 to ground potential will put the NR circuit in OUT condition and, by opening the connection, the NR circuit will be in IN condition.

7. **ENCORDING AMPLIFIER (IC702)**
The encording amplifier is provided inside IC702 and the input is switched from βNR IN to βNR OUT by means of the electronic switch within the IC. It is provided with negative feedback Pin 1 and output terminal Pin 2. The negative feedback input level is adjusted by R757 to control the gain of the recording amplifier.

8. **RECORDING COMPENSATION CIRCUIT I (C764, R786, C763, R785, C772, R796)**
The negative feedback elements C764, R786, C763 and R785 of the recording amplifier varies the impedance according to the frequency. A gentle upward sloping characteristic (approx. 5dB up for each 50 Hz in relation to 1 kHz) is realized from the medium region (approx. 50 Hz) thus compensating the low region. C772 and R796 compensate for the high region by providing a downward sloping characteristics with approximately 3dB up from the medium region (approx. 2 kHz) to the high region (approx. 10 kHz).

9. **RECORDING COMPENSATION CIRCUIT II (C711, R725)**
Recording compensated signal outputs from Pin 2 of IC702 passes through constant current resistor R725 and causes recording current to flow in the audio recording, playback head. C711 is connected in parallel with R725 and the current in the high region increases in relation to their time constants. The high range is further peaked with the resonant frequency determined by C711 and the audio recording/playback head.

10. **OUTPUT AMPLIFIER (IC702)**
The output amplifier is provided inside C702 and its input terminal is switched from NR IN to NR OUT by means of the electronic switches within the IC. This is composed of Pin 4 of the negative feedback input and Pin 3 of the output and is a flat amplifier with a gain of approx. 18dB.

11. **ALC CIRCUIT (Q714, Q715, D707, D706)**
Voltage doubler rectification of the output signal is carried out by D706 and D707 during recording and the small and large audio irregularities are converted to DC level fluctuations. If this DC level rises above approximately 1.4V, Q714 functions and reduces the impedance between the collector and emitter of Q715. An alternator mechanism is then formed with this impedance and the impedance of R743, R744 (when using a line) or R746, R747 (when using a mike) and this mechanism adjusts the input level of the pre-amp in IC702. If the DC level of Q714 exceeds approximately 1.4V, the impedance between the collector and emitter of Q715 will be further attenuated causing the signal attenuation to increase.

12. **ERASING OSCILLATOR CIRCUIT**
This is the oscillator circuit for the recording/playback head bias and the erasing current for the full width erasing head and the audio erasing head during recording and off recording. The circuit oscillates at approximately 55 kHz during recording and nonrecording. The oscillation frequency is determined by the full width erasing head, audio erasing head and the resonant circuit of C717, C719 and C721 during recording. The frequency during nonrecording is determined by the resonant circuit formed by the audio erasing head and C717. R754 is a VR for adjusting the oscillator frequency and the frequency can be changed at 3 points of right center and left. (right — f = intermediate, center — f = highest, left = f = lowest). As the REC +12V cannot be impressed on Q710 through a resistor, Q710 will be OFF during nonrecording periods. Due to the capacity of the shielded wire between Pins 4 and 5 of P702 and the rectification and charging of the oscillator voltage from D702, current flow in the full width erasing head is stopped throughout the entire oscillation voltage cycle. During recording, the RECORD +12V is applied to the base of Q710 through a resistor and sets Q710 in ON condition. Although the erasing oscillator voltage is rectified by D702, as the full width erasing head and the parallel resonant circuit of C719 are resonating at the oscillating frequency, the erasing current flowing in the full width erasing head will become sine waves. Furthermore, the other output from T701 is applied to the audio head through R753 and C716 and becomes the bias voltage. The circuit is arranged so the bias current can be adjusted by means of K753.

3-7 TIMER CIRCUIT

1. GENERAL OUTLINE

Specifications

The programme timer circuit is a timer incorporating a special one-chip timer microcomputer (MP2204) and a dynamic drive fluorescent indicator tube (FIP8AM10) and possesses the following functions.

(1) Clock

1) 24 Hour digital display and day display
2) Commercial power supply frequency synchronized clock (50/60 Hz automatic changeover)
3) Power failure back up (Approx. 10 minutes. Timing carried out with the clock in the microcomputer during the power failure.)

(2) Programme Timer

1) 3 Programme timer of daily repetition or weekly cycle. Memory in programme No. 3 is not cleared after operation. Memories in programme No. 1 and No. 2 are cleared after the first time excepting for the daily programmes.
2) The maximum recording tim e for 1 programme is 5 hours and 59 minutes.

Circuit Construction

As shown in the block diagram in Fig. 3-89, the programme timer circuit is composed of the control display section (Display), operating section (setting) and the timer power supply (Pre-Amp).

Microcomputer MP2204 receives inputs from the operating section and sends forth display output signals to the fluorescent display unit FIP8AM10 and control signals to the VTR set power supply, selection, logic and other circuits.

The timer circuit power supply is composed of IC (TL496CP) possessing series regulator and DC-DC converter functions and a backup battery for use during power failures. TL496CP normally functions as a series regulator but functions as a DC-DC converter during power failures and, stepping up the voltage from the battery, supplies this to the microcomputer.

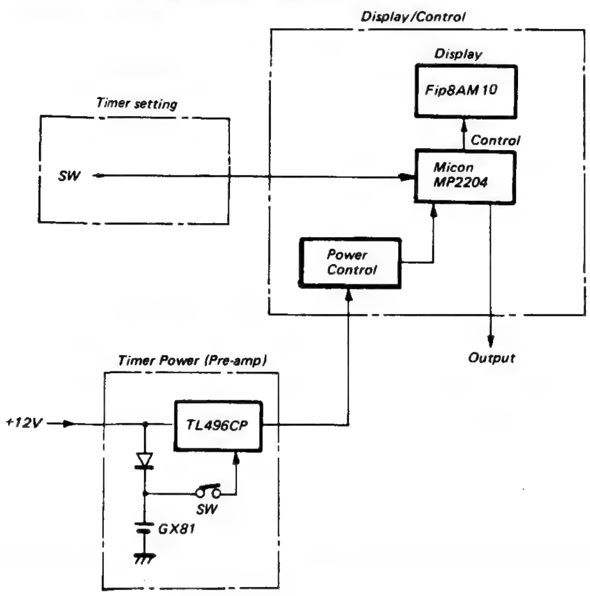


Fig. 3-89 Block Diagram

Fig. 3-90 shows the display pattern of the fluorescent display tube FIP8AM10.

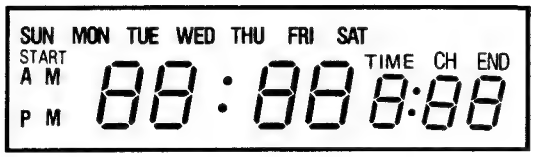


Fig. 3-90 Display Pattern

2. CLOCK OPERATION

The clock is a 24 hour display type and, as shown in Figure 3-91, displays on fluorescent display tube GX01. Sundays are also displayed. Clock timing is carried out based on commercial power supply frequencies (50/60 Hz). Changeover of the 50 Hz and 60 Hz frequency is carried out automatically by the microcomputer. The clock will not display during power failures. However, timing will be carried out during this period based on the clock in the microcomputer (400 kHz) if backed up by a battery.

When power is restored during back up operation with the battery, the colon will commence to flash. When power is restored after battery backup operation is over, power failure will be displayed.

When the VTR set power cord is plugged into a wall socket and the main power supply switch set on ON, power will be supplied to the timer circuit and circuit operation will commence. Initial setting of microcomputer ICX01 will be carried out at this time and power failure display will commence to flash as shown in Fig. 3-92. However, when the power supply switch SX01 is in ON or STANDBY position and more switch SX64 is in CLOCK SET position, only SUN will flash.

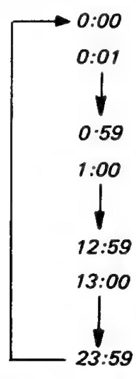
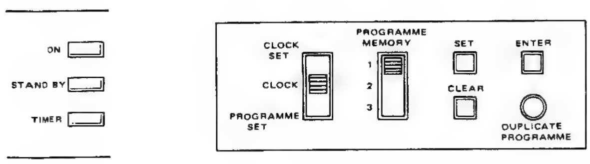


Fig. 3-91 Clock Display

Fig. 3-92 Power Failure Display (Flashing)

3. **SETTING THE TIME**

To set the time, power supply switch SX01 (Fig. 3-93A) must be in ON or STANDBY position. Clock setting can be carried out by setting mode switch SX64 in the operation section to the CLOCK SET position. Time setting will be recorded with data input by means of operating key – SET (SX61), ENTER (SX62). When CLEAR (SX63) is depressed, the time memory will be cleared and SUN 0:00 will be set. If mode switch SX64 is set to CLOCK SET position, SUN will commence to flash first. When set key SX61 is depressed, the days of the week will shift successively as shown in Fig. 3-94(a). When the desired day of the week arrives (monday, for example) and the ENTER key SX62 is depressed, "monday" will be displayed and the time digits will commence to flash. When SET key SX61 is depressed, the time figures will shift as shown in Fig. 3-94(b). If ENTER key SX62 is depressed at the desired time (for example 13), the time will shift as shown in Fig. 3-94 (b). If ENTER key SX62 is depressed at the desired time, the time display will be 13 and the 10 minute digit will now start to flash. Shifting of the 10 minute and 1 minute figures are shown respectively in Fig. 3-94(c) and 3-94(d) and recording is carried out by pushing the ENTER key as in the case of time. When the 1 minute recording is complete, the display will be as in Fig. 3-94(e) with END being displayed indicating that time setting is complete. Timing commences from the time that the mode switch SX64 is returned to the CLOCK position from CLOCK SET position. If mode switch SX64 is returned to CLOCK position before END is displayed, it will mean that set recording is incomplete and all operations to be recorded up to that time will automatically be cleared and the time prior to carrying out time setting will be displayed.



(a) (b)

Fig. 3-93

(a) SUN→MON→TUE→WED→THU→FRI→SAT

(b) 0→1→2→3→11→12→13→23

(c) 0→1→2→5

(d) 0→1→2→9

(e)

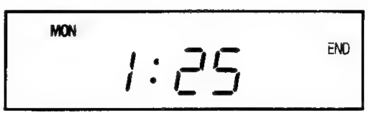


Fig. 3-94

4. **PROGRAMME SETTING**

Programme setting cannot be carried out unless the power supply switch SX01 is in ON position. When the desired programme No. is selected by pushing programme memory switch SX65 and mode switch SX64 is set to PROGRAMME position, the display will be as shown in Fig. 3-95(a) and (b) with the day of the week and START flashing. The display in Fig. 3-95(a) is when nothing is programmed. Fig. 3-95(b) shows a programmed display and this example shows that the unit is programmed for carrying out timer video recording on thursday for 2 hours and 30 minutes from 15:30 hours. (The CH position here is indicated by a CH indicator LED).

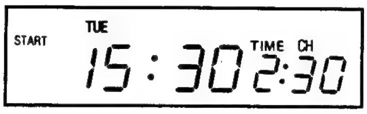
Inputting the TIMER ON time is carried out by the same method as used in time settings by means of SET key SX61 and ENTER key SX62. START will continue to flash until the ON time setting is completed. When the ON time setting is completed, TIME and recording time will commence to flash. Setting of the recording time is carried out in the same manner as in time setting by pushing the SET key and ENTER key in the order of 10 minute figures and 1 minute figures. TIME will continue to flash until the registration time setting is completed. When the recording time setting is completed, CH will next commence to flash. If the SET key is pushed at this time, the CH indicator LED will shift in successive order from position 1. If the ENTER key is pushed at the desired CH position, CH setting will be completed, END will be displayed and the programme will be registered in the programme No. of the PROGRAMME MEMORY switch SX65 position. Fig. 3-95(c) shows an example of a completed registration.

If CLEAR key SX63 is pushed during a programme, all memories for that programme will be cleared and the display will be as shown in Fig. 3-95(a). Also, if the video recording time is set to 0 hours 00 minute or programme setting is terminated before END is displayed, all input details will be automatically cleared and memory will revert to the state prior to starting programme setting.

If there is a temporary power failure or if the unit is on battery back up (when the colon is flashing in the time display) prior to programming, programme setting cannot be carried out. In cases of this nature, time setting should be carried out first.

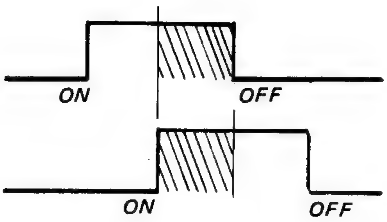
If the programme recording time overlaps as shown in Fig. 3-95(d), the DUPLICATE LED (see Fig. 3-93(b)) will light. When the programme is reset so the recording time no longer overlaps, the LED will go off. If programming is to be carried out in overlapped state, the LED can be turned off by returning mode switch SX64 from PROGRAMME to CLOCK. When executing the programme in overlapped state, it will be executed with priority on ON time. Programmes after ON time will not be executed. (See next chapter on programme execution).

(a)



(b)

(c)



(d)

Fig. 3-95

5. PROGRAM EXECUTION

To execute the program, power supply switch SX01 must be set to the TIMER position. When executing programmes at this time on which LED DX13 is lit (see Fig. 3-93(a)), PROGRAMME MEMORY switch SX65 position may be at any programme No. and operation will be according to memory details with priority on ON time.

The memory after program execution will be as shown in Table 3-13. In the case of daily programmes, memories of all program Nos. will be retained. Although the memory of programme No. 3 will be retained in the case of a specific day of the week and will be repeatedly executed from the following week, in programmes No. 1 and 2, memory will be cleared after execution.

Program No.	Daily	Specific Days of the Week
1	Retain	Clear
2	Retain	Clear
3	Retain	Retain

Table 3-13 Memory after Program Execution

Program Execution and Priority

(a) When the Programmes Shift and Overlap

As shown in Fig. 3-96(a), execution of the programs when the ON time of the respective programmes shifts and overlaps will be as follows.

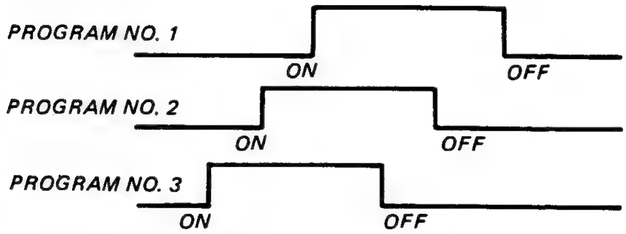


Fig. 3-96(a) Shifted and Overlapped Programs

Program No. 1	Execute on 3rd week
Program No. 2	Execute on 2nd week
Program No. 3	Execute on 1st week

(b) When ON Time is set on the Same Time

Program execution when the ON time is set on the same time as shown in Fig. 3-96(b) will be as follows.

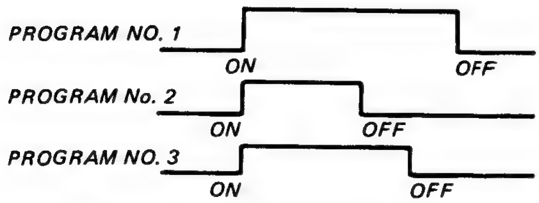


Fig. 3-96(b) Program with ON Time Set on Same Time

Program No. 1	Execute on 3rd week
Program No. 2	Execute on 2nd week
Program No. 3	Execute on 1st week

Relations between Programme Setting Time and Power Supply Switch SX01 and Temporary Power Failure

The relation between program setting time and power supply switch SX01 and with temporary power failure is as shown in Table 3-14.

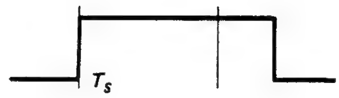
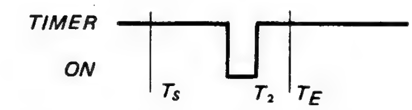
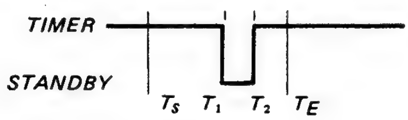
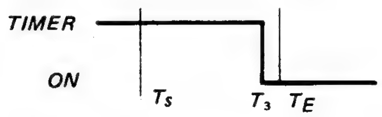
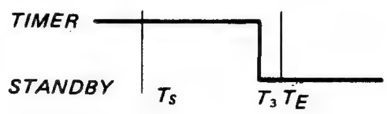
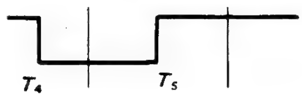
Item		Time Chart	Programme Execution
Programme			
SX01	ON or STANDBY ↓ TIMER		Executes according to programme setting
	ON or STANDBY ↓ TIMER		Will not execute (Executes the next day or following week)
	ON or STANDBY ↓ TIMER		Ditto
	TIMER ↓ ON ↓ TIMER		Executes from T_S to T_2. Does not execute from T_2 to T_E
	TIMER ↓ STANDBY ↓ TIMER		Executes from T_S to T_1. Does not execute from T_1 to T_E
	TIMER ↓ ON		Executes from T_S to T_E. REC. condition continues from T_E
	TIMER ↓ STANDBY		Executes from T_S to T_3. Does not execute from T_3 to T_E
Power Failer	$T_4 \sim T_5$		Does not execute. Executes following day or following week
	$T_4 \sim T_S$		Same as above
	$T_4 \sim T_6$		Executes according to programme setting
	$T_S \sim T_7$		Does not execute. Executes following day or following week
	$T_8 \sim T_9$		Executes from T_S to T_8. Does not execute from T_8 to T_E. Memory retained.

Table 3-14

6 CIRCUITOPERATION

Fluorescent Indicator Tube and Its Drive

The fluorescent indicator tube is of the same construction as the direct heating type triode vacuum tube and its construction is shown in Fig. 3-97. THe fluorescent indicator tube is composed of the glass plate, wire type filament, mesh type grid and the plate with a film of fluorescent substance. The filament is of tungsten coated with carbonate and is of the direct heating type. Thermionic emission is carried out when filament voltage (e_f) is applied. In the fluorescent indicator tube, thermions emitted from the filament are accelerated by the voltages impressed on the grid and plate and these accelerated thermions strike the fluorescent substance on the surface of the plate causing it to luminesce. Therefore, luminescence will not occur if there is no voltage on the grid or plate. Fig. 3-98(a) shows a fluorescent indicator tube drive circuit for 1 digit. When fluorescent indicator tube GX01 (FIP 8AM10) is lit, it requires 28V for both the plate (E_b) and Grid (E_c) and, when off, voltage must be E_b = −1 V and E_c = −4 V.

To drive the fluorescent indicator tube directly with the microcomputer in this timer circuit, voltage relations are as shown in Fig. 3-98(b). The heater/cathode filament is heated by a continuous supply of AC $3.2V_{rms}$ from the heater transformer. The heater is biased with a DC potential of −18V. On one hand, when off, the plate and grid are biased by means of a resistor to a voltage −4 volts below the filament bias voltage of −18V or at −22V (extinguishing voltage). To light the desired segment in the desired digit in this condition, it will only be necessary to set the grid and plate corresponding to those in Table 3-15 to a high voltage (+10V).
The relation between the display pattern and the grid is shown in Fig. 3-99. Table 3-16 shows the relation between the output terminal of the microcomputer and the grid segment.

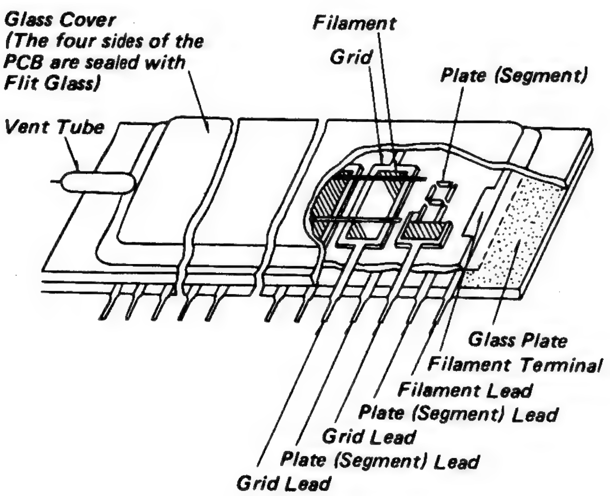


Fig. 3-97 Construction of the Fluorescent Indicator Tube

Segment / Grid	a	b	c	d	e	f	g	h
G9	START	AM	PM	–	–	–	SUN	MON
G8	a	b	c	d	e	f	g	TUE
G7	a	b	c	d	e	f	g	WED
G6		–	–	–	–	–	–	THU
G5	a	b	c	d	e	f	g	FRI
G4	a	b	c	d	e	f	g	SAT
G3	a	b	c	d	e	f	g	TIME
G2	a	b	c	d	e	f	g	CH
G1	a	b	c	d	e	f	g	END

Table 3-15

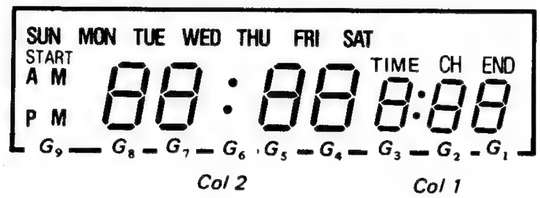


Fig. 3-99

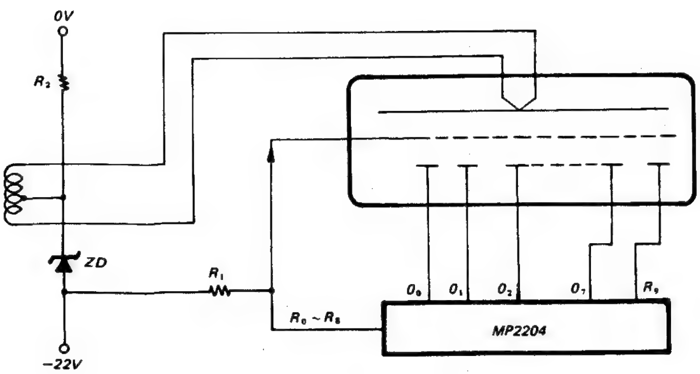


Fig. 3-98 (a)

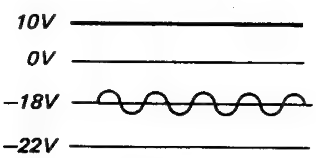


Fig. 3-98 (b)

Grid		G1	G2	G3	G4	G5	G6	G7	G8	G9
Micro-computer	Output Terminal	R_8	R_7	R_6	R_5	R_4	R_3	R_2	R_1	R_0
	Terminal No.	38	37	36	34	33	32	31	30	29
Segment		a	b	c	d	e	f	g	h	
Micro-computer	Output Terminal	O_0	O_1	O_2	O_3	O_4	O_5	O_6	R_9	
	Terminal No.	25	24	23	19	18	17	16	39	

Table 3-16

For example, the drive output timing of the micro-computer of the display example (Fig. 3-100(a)) during program setting is shown in Fig. 3-100(b).

Fig. 3-100(a) Example of Display

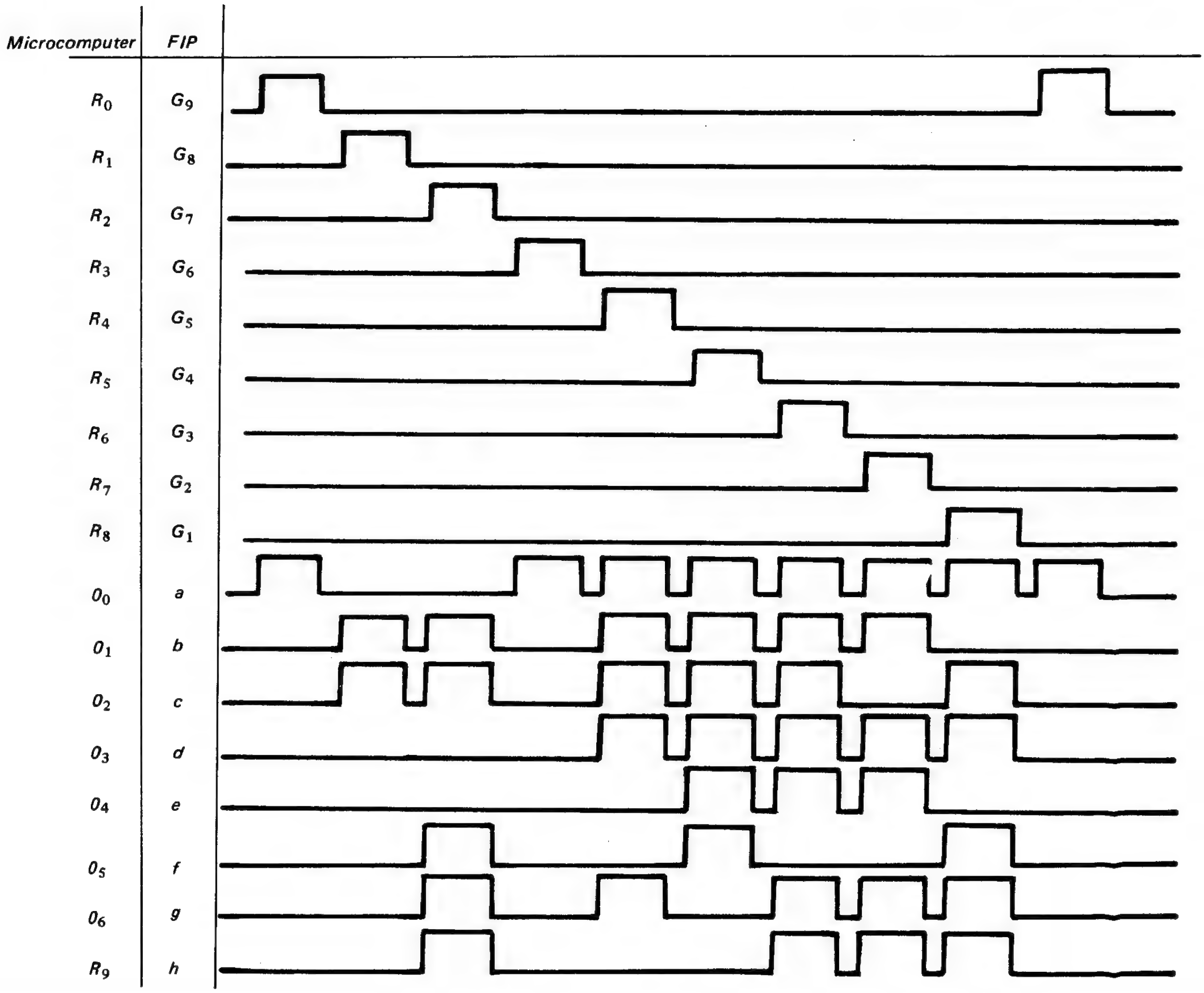


Fig. 3-100(b)

Microcomputer Function

The pin positions of microcomputer ICX01 are shown below and the terminal functions are shown in Table 3-17.

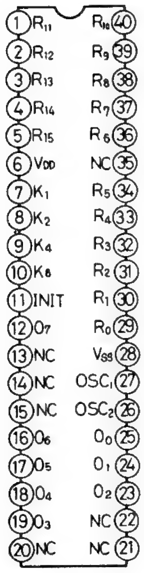


Table 3-17

Terminal	Function
$O_0 \sim O_6$, R_9	Segment drive of fluorescent indicator tube GX01 (See Table 3-16.)
$R_0 \sim R_5$	Grid drive of fluorescent indicator tube GX01 (see table 3-16) and read-in for setting switch mode.
$R_6 \sim R_8$	Grid drive of fluorescent indicator tube GX01. (Table 3-16)
R_{10}	Outputs SET power supply ON signals during TIMER REC.
R_{11}	Outputs REC command signals during TIMER REC.
R_{12}	Outputs signal to reset CH to position 1 during PROGRAMME mode and TIMER REC.
R_{13}	Outputs shift pulses to shift CH to a specified position during PROGRAMME mode and TIMER REC.
R_{15}	Outputs signal indicating overlap of programme time.
K_1, K_2, K_4	Signal input from the setting switch
K_8	AC Clock input
INIT	Initializing terminal of microcomputer when power is applied.
OSC_1, OSC_2	Clock oscillator terminal of microcomputer
V_{DD}, V_{SS}	Power supply terminal of micro computer. V_{DD} = GND V_{SS} = 10V

Setting Switch and Microcomputer Input Circuit

There are 3 input terminals usable in microcomputer ICX01. For this reason, a key scan input system using grid drive pulses for fluorescent indicator tube GX01 is employed for each input. The basic circuit is shown in Fig. 3-101(a). 12H/24H change over, 3-programme mode and brightness cannot be changed as wiring was carried out against patterns matching set specifications. The circuit shown in Fig. 3-101(b) is a circuit to prevent erroneous operation when the MODE switch is set to PROGRAMME.

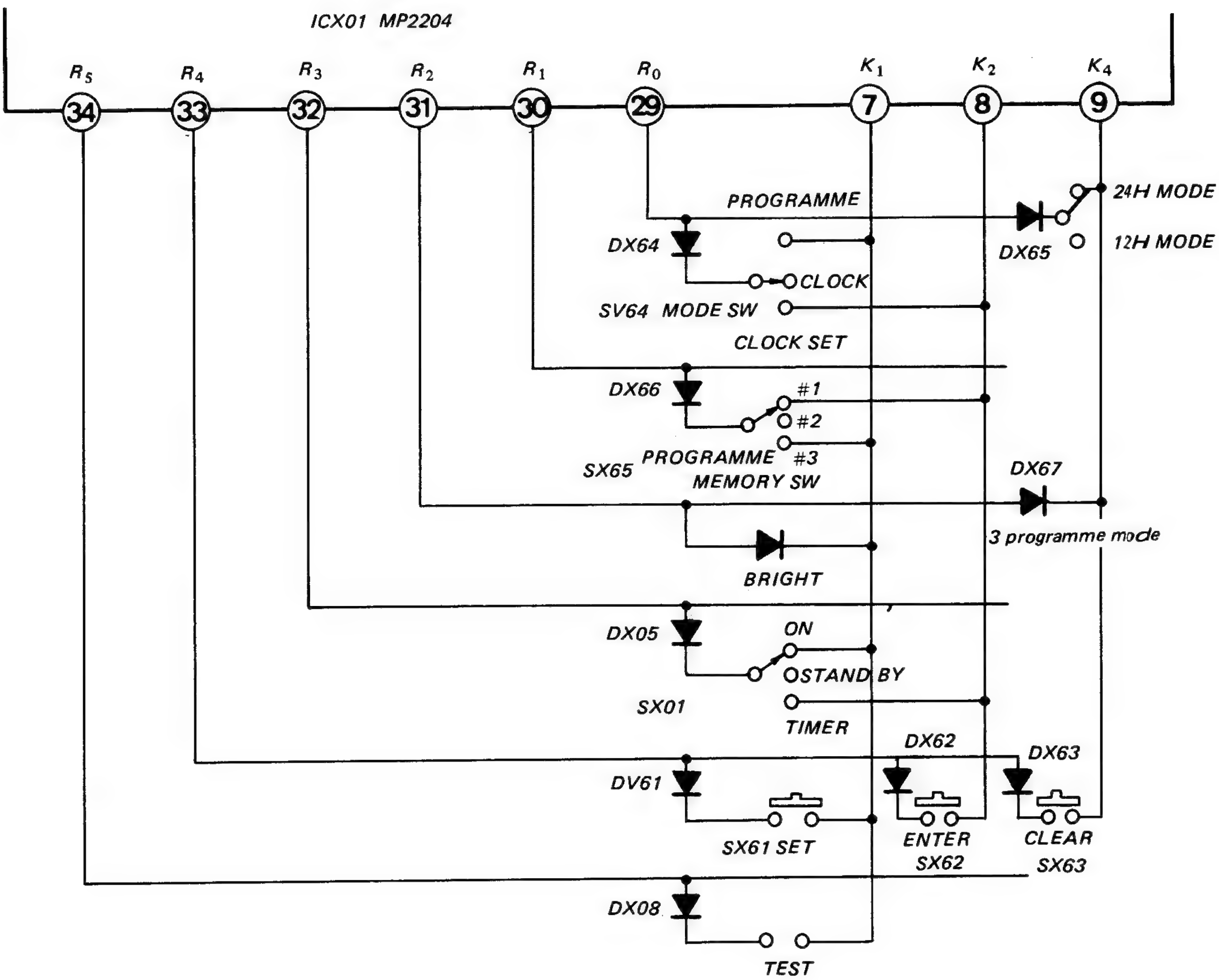


Fig. 3-101(a) Setting Switch Input Circuit

The test terminal is a terminal to permit advancing the clock at approximately 60 times the normal speed by short circuiting it.

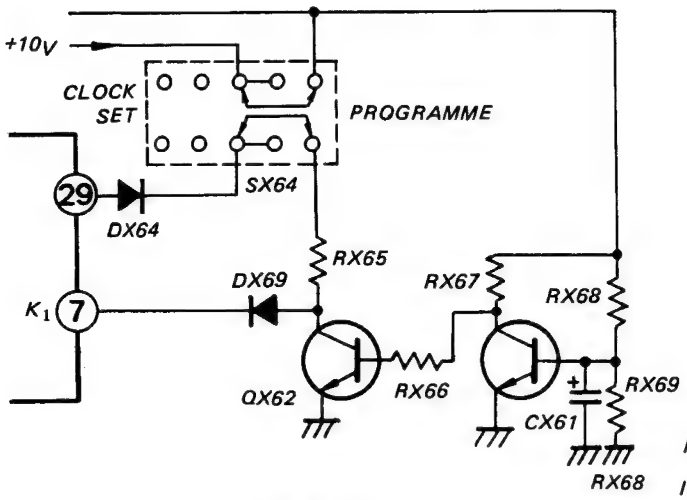


Fig. 3-101

AC Clock Input Circuit
The half wave rectified 50 Hz (or 60 Hz) input from the power supply circuit is wave formed by QX04 and QX05 and fed to Pin 10 of ICX01. The clock is advanced by this input. Immediately after the power supply is turned on, microcomputer ICX01 compares the input frequency with its clock (400 Hz) and automatically judges whether it is 50 Hz or 60 Hz.

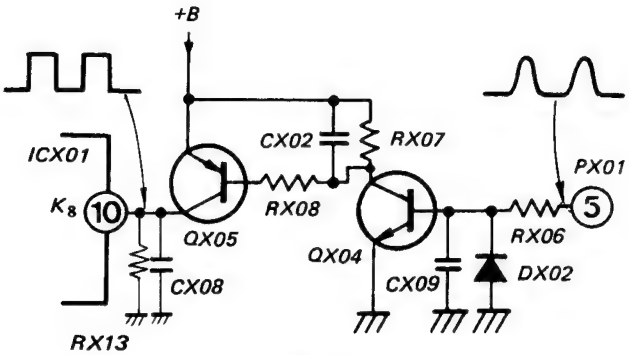


Fig. 3-102

Initial Set
Initial setting of microcomputer ICX01 by differentiating the initial power supply voltage with its differentiating circuit composed of CX07 and internal resistance R_{in} of Pin 11 and supplying a reset voltage. DX03 and DX04 are diodes for protective purpose.

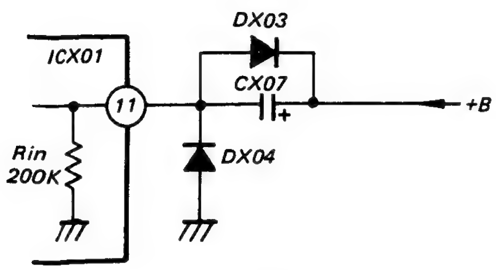


Fig. 3-103

Output Signal During Timer Operation
Outputs signal from Pin 40 (R_{10}) of ICX01 to turn power switch on when the programmed TIMER ON time arrives. With this POWER ON signal, power is supplied to the video set proper and the tuner section and REC will be in standby condition. Next, CH Reset pulses will be sent forth according to the timing shown in below and will reset the tuner CH to position 1. After the CH RESET pulses, CH SHIFT pulses will be emitted to advance CH to its specified position. Outputs of the CH SHIFT pulse will be 1 less than the specified positions. For example, when there are 8 specified positions, there will be outputs of only 7 CH SHIFT pulses. Next, REC signals are emitted 0.7 sec. after outputs of the POWER ON signal and the Logic CTL circuit will be put in REC mode and REC will commence.

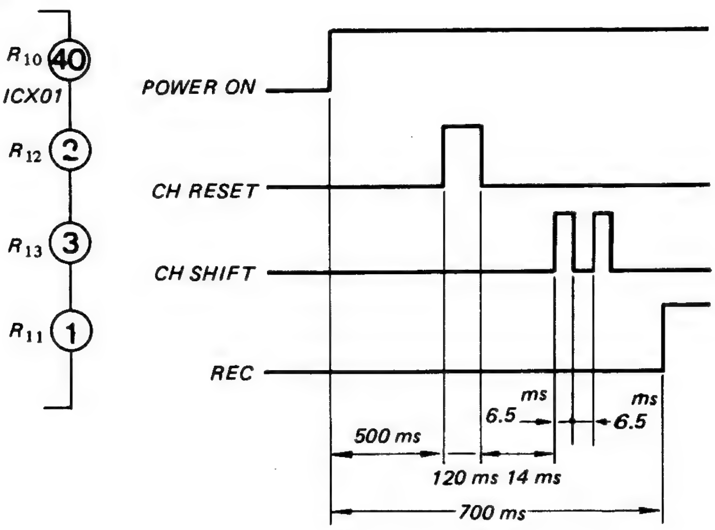


Fig. 3-104

Timer Power Supply

Power supply for the microcomputer and peripheral circuits directly related to the input of the microcomputer is supplied from the timer power supply circuit shown in Fig. 3-105 through a power supply control circuit.

Timer Power circuit charges the Battery GX81 (NiCd) normally to supply the power to microcomputer while Power line is interrupped. This Block diagram is shown in Fig. 3-105 ICX81 (TL496CP) of the timer power supply normally functions as a series regulator and outputs 10V approx. from pin 8 on inputs from pin 4.

When power is off, ICX81 detects the voltage in its voltage detector circuit and will function as a switching regulator automatically.

During a power failure, the charging voltage of battery GX81 is applied to pin 2 of ICX81, then, ICX81 makes an oscillation with internal capacitance and LX81 connected between pin 2 and 6.

While oscillation, ICX81 outputs 9V approx. from pin 8 to the microcomputer through smoothing capacitor CX82 and power control circuit consisting QX02 and QX03.

QX85 is held in on by QX84 and supplies charging voltage of GX81 to pin 2 of ICX81

On the other hand, DX82 makes a reference voltage from output voltage of pin 8 of ICX81.

QX82 compares the voltage of GX81 with above mentioned reference voltage and when voltage of GX81 decreases less than 3V, Q83 will turn on to turn QX84 off.

When QX84 is off, also QX85 will be turned off to prevent to overdischarge of GX81.

The period of this back-up operation by GX81 is depended on the charge condition of GX81. When GX81 is fully charged, this gives 10 min for back-up operation. The power supply control is a circuit to ensure that the function of supplying power supply voltage to the microcomputer is carried out only when the power supply voltage (ICX81 Pin 8 Output) exceeds the minimum operating voltage V_0 = 8.3V of microcomputer ICX01. DX01, RX01 and RX02 are arranged so that QX02 will go ON and OFF at V_0 = 8.3V. When QX02 goes on, QX03 will also go on and will supply voltage to the microcomputer with-in its operating voltage range. In the event that the voltage from battery GX81 drops during a power failure, and the voltage on Pin 8 of ICX81 also drops. QX02 will go off at V_0 = 8.3V and QX82 and QX83 will also go off. This stops voltage supply from the battery and thus prevents the battery from over discharging.

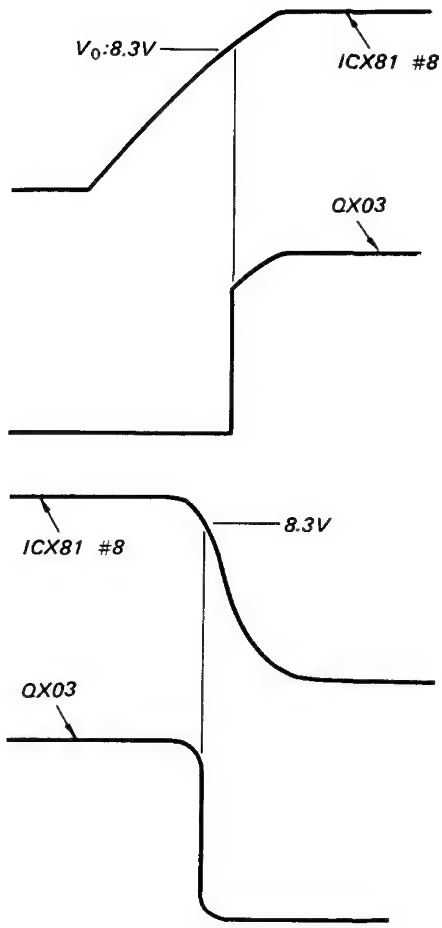


Fig. 3-106

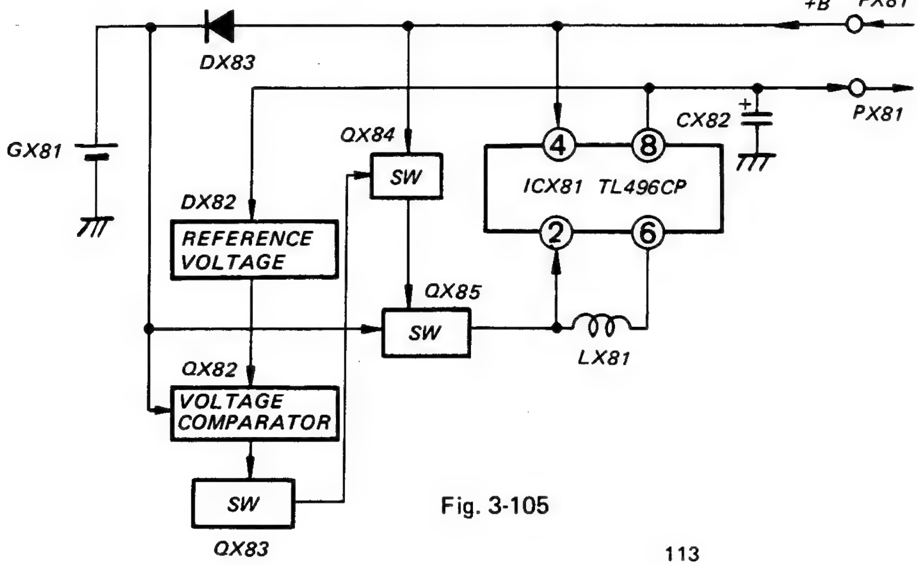


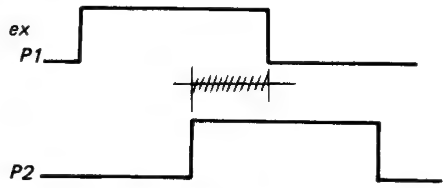
Fig. 3-105

METHOD OF TIMER USAGE

No.	Item	SW Position SX01	SX64	SX65	SX61, 62, 63	Display
1.	MAINS SW ON	*	*	*		$\boxed{\text{SUN}}$ $\boxed{\text{0:00}}$
2.	Time Setting	ON or STANDBY	CLOCK SET	*		$\boxed{\text{SUN}}$ 0:00
					SET	SUN → MON → → SAT
					ENTER	MON $\boxed{0}$: 00
					SET	0 → 1 → → 23
					ENTER	MON 13: $\boxed{0}$0
					SET	0 → 1 → → 5
					ENTER	MON 13:3$\boxed{0}$
					SET	0 → 1 → → 9
					ENTER	MON 13:35 END
3.	Time correction	ON or STANDBY	CLOCK SET	*		Keep ENTER key depressed until the place requiring correction (ex. 13:35 to 13:36) commences to flash.
						MON 13: 3$\boxed{5}$
					SET	MON 13: 3$\boxed{6}$
					ENTER	MON 13:36 END
						Note: Both display and memory will be set to SUN 0:00 by means of CLEAR. Subsequent functions according to 2.
						SUN 0:00
4.	Clock Display	*	CLOCK	*		MON 13:36

Note: 1. * indication shows any position of switch.
2. □ indication in Display shows flashing.

No.	Item	SW Position				Display
		SX01	SX64	SX65	SX61, 62, 63	
5.	Programme	ON	PRO-GRAMME SET	P1		SUN START 0:00 0:00 TIME CH
					SET	SUN → MON → → SAT → SUN ~ SAT Note: SUN ~ SAT Display indicates no specified day (That is, will be daily execution.)
					ENTER	MON TIME CH START 0 : 00 0 : 00
						TIMER ON time setting is the same as present time setting. However, START will continue to flash until time setting is completed.
						MON TIME CH START 12 : 50 0 : 00
					SET	0 → 1 → → 5
					ENTER	MON TIME CH START 12 : 50 2 : 0 0
					SET	0 → 1 → → 5
					ENTER	MON TIME CH START 12 : 50 2 : 3 0
					SET	0 → 1 → → 9
					ENTER	MON TIME CH START 12 : 50 2 : 35
					SET	CH Display LED lights and shifts successively and advances to the desired CH.
					ENTER	MON TIME CH END START 12 : 50 2 : 35
				P2		Ditto
				P3		Ditto

No.	Item	SW Position				Display
		SX01	SX64	SX65	SX61, 62, 63	
6.	Program Overlap	ON	PROGRAMME SET	*		When the recording time overlaps during program time setting (see below), the duplicate PGM LED lights.  As programming is possible in this condition, setting SX64 from PROGRAMME SET to CLOCK or CLOCK SET will cause the LED to go off. To correct program overlap, follow procedures in 5. As in the case of time correction in 3, push the ENTER key until the place requiring correction commences to flash.
7.	Program Confir-mation	ON	PROGRAMME SET	*		Details of the respective programs are displayed at position SX65 (1, 2, 3). Although the days of the week and START will flash at this time, if SX01, SX64 and SX65 are set to a different position, memory will be retained in its original state.
8.	Timer REC.	TIMER	*	*		Display is the present time. Automatically records in accordance with the programmed ON time, video recording time and CH.
9.	Release of Timer REC. (I)	TIMER STAND-BY	8	8		If SX01 is switched from TIMER to STANDBY during TIMER REC, REC will be released. The program will not be executed even if switched back to TIMER.
10.	Release of Timer REC. (II)	TIMER ON	*	*		If SX01 is switched from TIMER to ON during TIMER REC, REC will continue again. REC can be released at this time by pushing the STOP button.
11.	Release of Timer REC. (III)	TIMER	*	*		REC will not be released even if the STOP button is pushed during TIMER REC. Release will be possible by following the procedures in 9 or 10.

3-8 TUNER SYSTEM

Electronic Tuner, PIF, and Selector Circuit

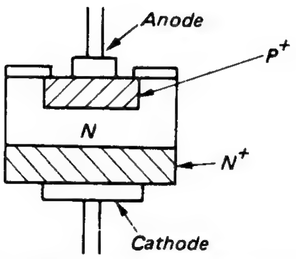


Fig. 3-107 Varactor Construction

The varactor, as illustrated in Fig. 3-107, is a PN junction diode characterized by a voltage-sensitive capacitance. In the figure, P+ is a region where a trivalent impurity is doped in bulk, and N is a region where a pentavalent impurity is doped little. If a reverse bias is applied to the varactor, or if a negative voltage is connected to the anode and a positive voltage to the cathode, an electric double layer called the "depletion layer" having no mobile carrier charge is forward at the junction between P+ and N. The capacitance of the imaginary capacitor formed by the charges of the depletion layer can be varied as a function of the reverse bias.

The equivalent circuit of the varactor is shown in Fig. 3-108. In general, RN > Rp + and RN > RN+. Also, RN is high with the capacitance. The varactor made of silicone variable in the capacitance from 2 pF (30 V) to 12 pF (3 V) has RN around 0.5 Ω at maximum. A usual variable capacitor, the equivalent circuit of which is represented by C and R in series, has R around 0.01 Ω involved mainly in the rotor contact. Such a high RN as compared with R of the variable capacitor is one of most important difficulties affecting the characteristics of the varactor, particularly in inhibiting high Q of the tuning circuit. High sensitivity cannot be obtained by the tuning circuit, but a proper NF and gain are obtained.

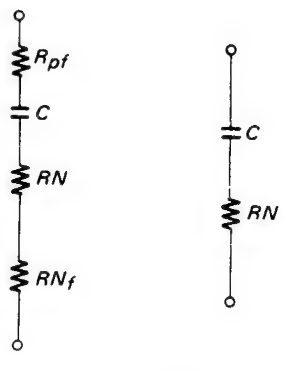


Fig. 3-108 Varactor Equivalent Circuit

PIF Circuit

The IF signal entered from Tuner on the Selector Circuit board is amplified around 18 dB by the ground-emitter IF amplifier Q001. L001 and R001 are placed to make the input impedance to 75Ω at the center frequency for to minimize response change due to the IF cable. L002 is tuned at a frequency with the input capacitance of the surface acoustic wave filter, which will be described in the following paragraphs, to make the IF amplifier frequency response rather flat. Q003 blocks the flow of the DC current to the surface acoustic wave filter. The IF amplifir is placed to compensate for the insertion loss of the surface acoustic wave filter.

The surface acoustic wave filter services to pass the signal in the IF band, to trap the signals in the adjacent channels 1.5 MHz above and 7 MHz below the picture carrier frequency, and also to trap the audio signal at 5.5 MHz below. The surface acoustic wave filter needs no alignment and is improved in the reliability and reduced in the number of parts used as compared with the conventional filters comprised of inductors and capacitors.

The surface acoustic wave is similar to the wave propagation caused on water surface, such as a pond, when a stone is thrown in. The surface acoustic wave propagates on the boundary between an elastic and air, or on the surface of the elastic.

The surface acoustic wave filter is illustrated in Fig. 3-110. As shown in the figure, an input and output inter-digital transducers are put on piezoelectric substrate. If a AC voltage is applied to the input transducer, an AC electric field is produced between the electrodes of the input transducer on the surface of the substrate. The electric field causes a mechanical expansion and contraction, or an elastic strain. The strain energy is concentrated and propagates rightly under the surface of the substrate. The propagating waves are summed up and received by the output transducer.

The propagation velocity of the surface acoustic wave denoted by Vs is determined in terms of the substrate characteristics and crystal structure. The amplitude is in proportional to the strength of the electric field produced by the input voltage and of the distance between the two transducers. The center frequency denoted by fo is given by

$$fo = \frac{Vs}{\lambda}$$

where λ is the interval of the inter-digits of the transducer. The amplitude of the surface acoustic wave produced by a pair of opposite digits is in proportion to the interpolation of the digits. The phase of the acoustic wave depends on the positions of the digits.

The bandwidth of the filter is narrow and the impedance is low with increase of the number N of pairs of opposite digits as this increases the stress by signals around the center frequency. The frequency response of the product of those of the two transducers, or the exciting (input) transducer and receiving (output) transducer. If the receiving transducer has a few interdigits, the frequency respone of the filter depends to a high degree on that of the exciting transducer.

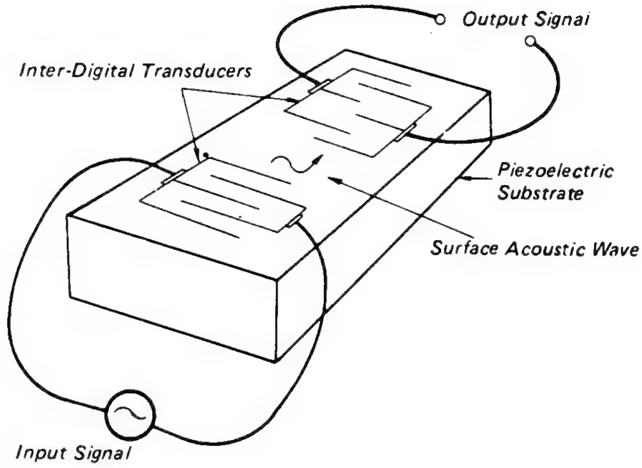


Fig. 3-110 Surface Accoustic Wave Filter Structure

The surface acoustic wave filter (hereinafter referred to as "PSF filter") is designed so that its center frequency should be around 37 MHz and the bandwidth is selected to minimize the adjacent video and audio frequency responses. These are achieved by properly determining the interval and number of the digits of the exciting transducer and by making flat the frequency response of the receiving having a few digits.

As shown in Fig. 3-111 below, the signal passed the PSF filter enters pins 1 and 16 on IC002 (TA7607AP) and is magnified 57 dB by the IF amplifier, consisting of three differential amplifier stages. The IF amplifier can be gain-controlled up to 63 dB as a succeeding stage controls the gain of the preceding stage in sequence, thereby providing good signal-to-noise ratio. The IF amplifier, also, has a DC feedback from the output to the input to minimize undesired offset in the differential amplification.

The amplified PIF-signal is taken out and routed by the emitter follower into the "and" circuit, or the multiplier, and through the other emitter follower the differential amplifier having the 38.9 MHz tuning network and limiter as loads. The limiter restricts the signal to produce the video carrier of a constant amplitude. The video carrier is led as a switching signal to the "and" circuit. The "and" circuit homodyne-detects the video signal from the PIF signal with use of the switching signal. The video signal is magnified by the grounded-base amplifier and is fed out through the emitter follower.

Also, the switching signal is divided into two parts: one is directly led to and the other through an external 90° phase shifter to the other "and" circuit. This "and" circuit produces a DC voltage that corresponds to the frequency difference between the two signals. The DC voltage is magnified for use as the AFT voltage.

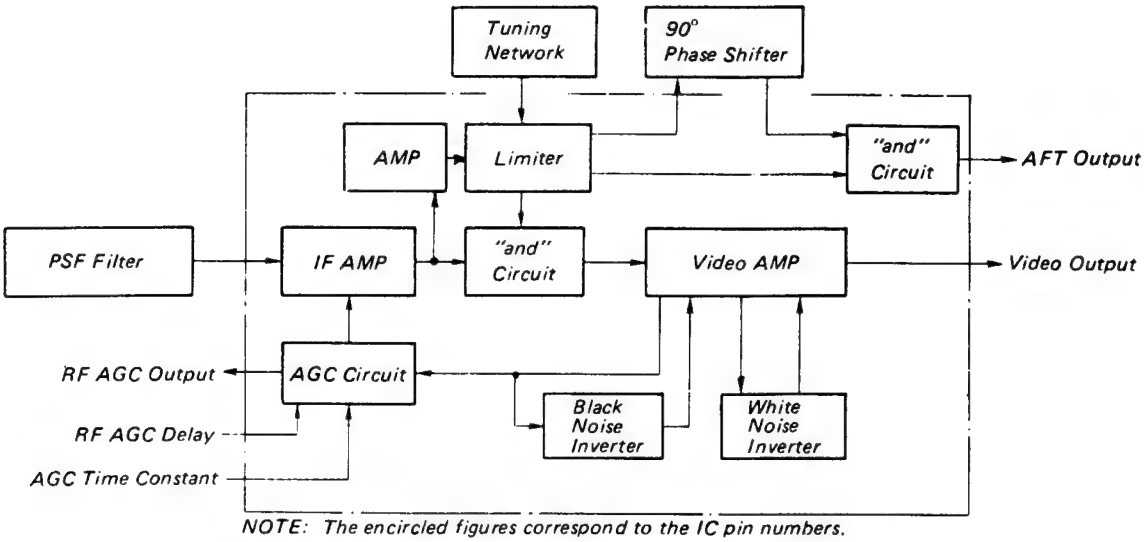


Fig. 3-111 PIF IC (TA7607AP) Block Diagram

In addition to the above-mentioned functional circuits, the PIF IC (TA7607AP) contains a black noise inverter and white noise inverter that cut out undesired noises to clamp to certain levels as illustrated in Fig. 3-112.

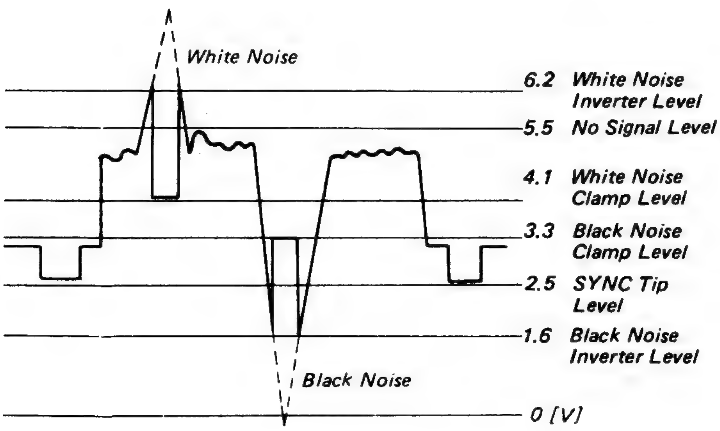


Fig. 3-112 Noise Clamp Levels

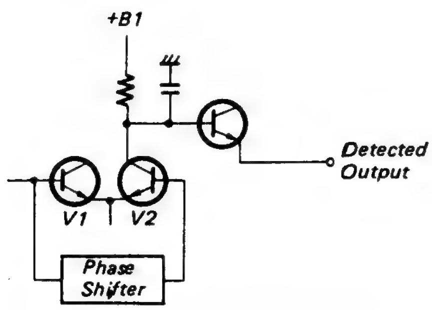


Fig. 3-113 Differential Amplifier Circuit

The video signal fed out from pin 12 of the PIF IC is divided into two parts: one passed the 5.5 MHz audio trap to eliminate the audio signal and is output by the emitter follower having 75Ω output impedance; and, the other passes the 5.5 MHz ceramic bandpass filter and is fed to the Audio Detection IC003 (TA7176AP). In the Audio Detection IC, the SIF signal is limited and amplified by three differential amplifier stages and passes the low pass filter which eliminates the harmonic components to improve the AM suppression ratio. The SIF signal, in turn, is divided into two routes: one is directly connected to the input of the differential amplifier and the other to the phase shifter, comprised of a ceramic filter, where the signal is phase-shifted 90° and also is fed into the differential amplifier. As the SIF signal is deviated from 5.5 MHz, the signal passing the phase shifter deviates more than 90°. This deviates the turn-on and turn-off periods of time, that is, the audio signal is frequency detected.

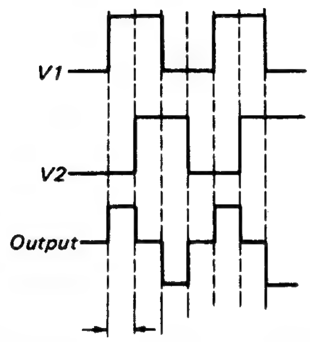


Fig. 3-114 Differential AMplifier Time Chart

Selection Circuit

General

The selector circuitry functions to apply the tuning voltage to the electric tuner corresponding to the channel select button pressed for desired channel, together with indicating the position of the button pushed, and to indicate the desired channel by means of shift pulses from the timer.

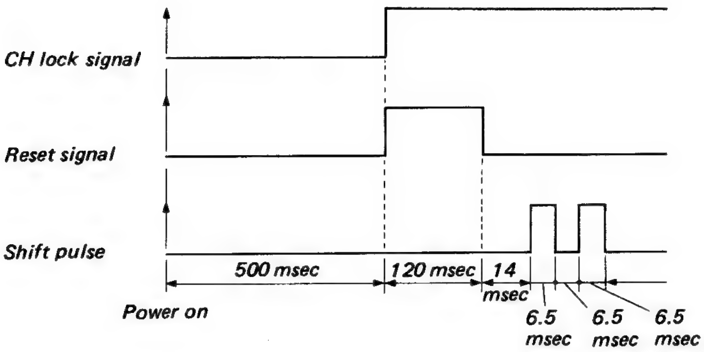
(1) RECORD (EE) mode

In the normal mode (when the selection is accomplished by pressing the Channel select button), when H input (high level) pulses are applied to pin 18 of IC ICA01 (upc1363C), the output is shifted 1 channel at a time in the direction of pin 1 and pin 24 from pin 11 by means of the oscillation frequency (approx. 0.5m sec.) determined by CA02 and RA02 connected to pin 17 on ICA01.

This output is in open collector state with the 'on' channels at the ground potential and other 'off' channels at +32V.
When wave inputs are received in the buil-in tuner of VTR, QA03 will go on during the charging time determined by RA09 and CA06 as RA14 (3.3K ohm) is smaller than RA09 (100K ohm) and drives pin 11 to H, pin 18 level will go to H and output will commence to shift.
When this output applies to pin 11, the shift will stop as pin 18 level will go to L (low level).

(2) Timer mode

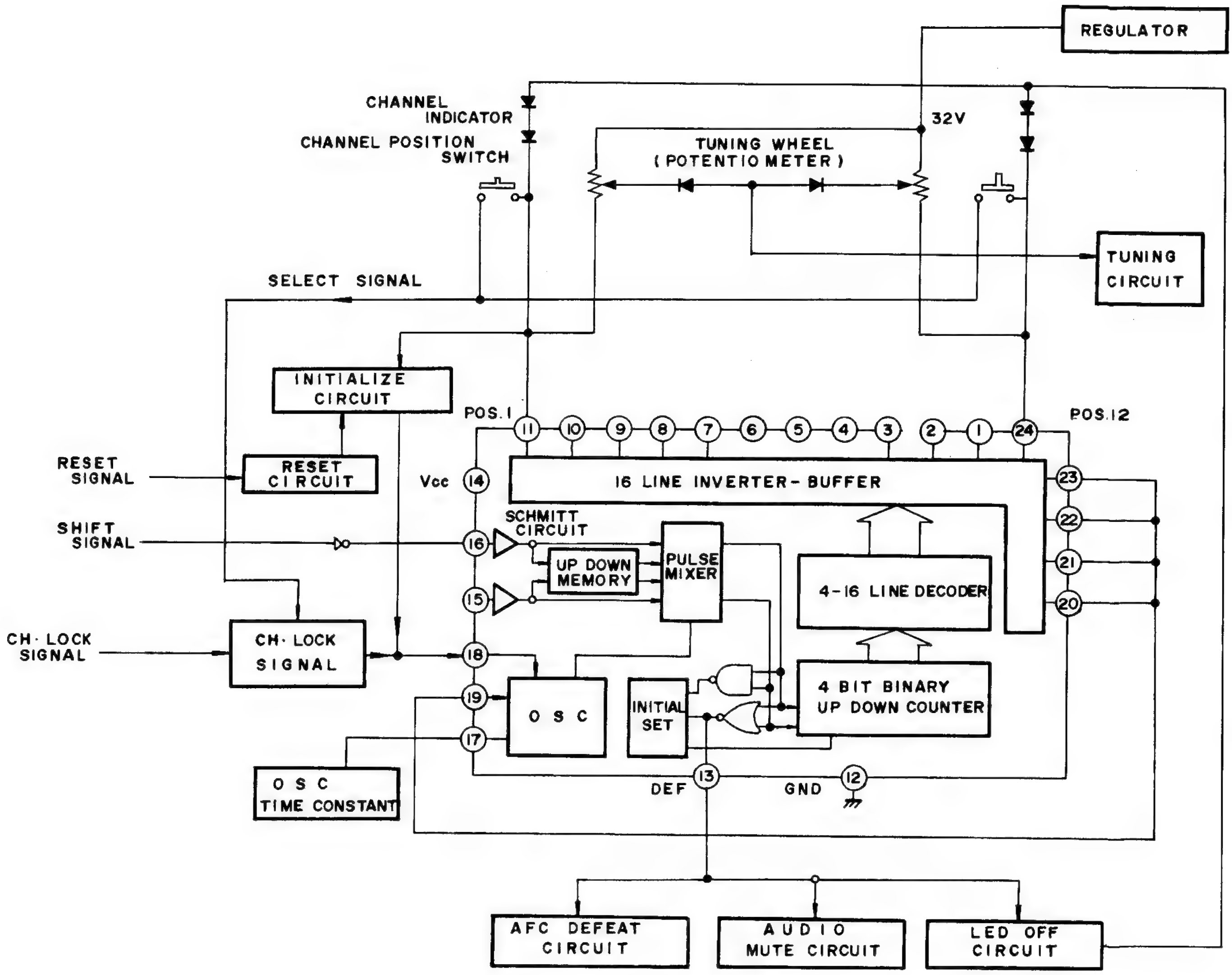
When the power supply is turned on at the preset time with the VTR in timer mode, high level signals are applied from the timer as shown the diagram below.



As QA05 is turned on through RA10 when channel lock signal is applied and QA09 and QA02 are turned off, the signal from the channel select button will not be applied to pin 18.
Changing the channels is therefore not possible during the timer operation. When the reset signal is applied, QA06 will be turned on and intializing operation is accomplished by discharging CA06.
Next, QA08 is turned on the same number of times as the shift pulses and each time the level at pin 16 changes from L to H and vice versa, the channels are shifted one at a time and the preset channel selected.

Channel indicator, Channel position switch, Tuning wheel (potentiometer) Regulator circuit, Tuning circuit, Select signal, Initializing circuit Reset signal, Shift signal, Channel lock signal, Reset circuit, Channel lock circuit, OSC time constant, AFC defeat circuit, Audio mute circuit, LED off circuit.

Also, when pin 11 level is at L, pin 18 level will also be at L and the shift will not occur. The foregoing is the initializing operation where the extreme left channel position is selected when the power supply is switched on. Next, As the +12V will be applied to pin 18 through RA16, DA55, DA67 and position switch QA02, RA02 when the 5th channel button from the left is pressed, the output will shift to pin 7 from pin 11 2msec later.
Then, as the position switch QA02, RA02 go to low level, the shift will stop. The level at pin 13 will go to L during this period, QA07 will turn on, QA04 will also turn on, the indicator power supply will be cut off and the indicator LED will be turned off.
Q003 will then be turned on, AFT will be turned off and the level at pin 6 of IC006 will go to H through DA03 and the audio mute will be applied. As 'L' is retained on pin 7, the current flows through RA16, DA55 and DA67 causing DA67 luminance and indicate the channel.
Also, as a +32V is extracted from the +45V by means of D004 and is applied to one side of potentiometer R055 and R056, the desired tuning voltage may be obtained through DA79 by turning the potentiometer. This tuning voltage is applied to the electric tuner by means of the emitter flow from the temperature compensator Q007. The same method of the selection is possible when any other channel buttons are pressed.



REGULATOR
CHANNEL INDICATOR
CHANNEL POSITION SWITCH
32V
TUNING WHEEL (POTENTIOMETER)
TUNING CIRCUIT
SELECT SIGNAL
INITIALIZE CIRCUIT
POS.1
POS.12
RESET SIGNAL
RESET CIRCUIT
Vcc
16 LINE INVERTER-BUFFER
SHIFT SIGNAL
SCHMITT CIRCUIT
UP DOWN MEMORY
PULSE MIXER
4-16 LINE DECODER
CH·LOCK SIGNAL
CH·LOCK SIGNAL
4 BIT BINARY UP DOWN COUNTER
OSC
INITIAL SET
OSC TIME CONSTANT
DEF
GND
AFC DEFEAT CIRCUIT
AUDIO MUTE CIRCUIT
LED OFF CIRCUIT

3-9 POWER SYSTEM

1. **General**
The power system consists of a power transformer T802, an AC noise filter circuit, and voltage regulator circuits.
These are accommodated in the line filter circuit board, the Power supply circuit board and the Power Drive circuit board.

2. **Power Circuit Boards**
The Line filter circuit board contains an AC noise filter circuit, 47V and –23V rectifier circuits, 47V and –23V voltage regulator circuit, Power line switching circuit and filament voltage supply circuit.
The Power Supply circuit board contains a 12V rectifier circuit, E12V rectifier circuit, 12V differential amplifier circuit, E12V regulator circuit and heater line switching circuit.
The Power Drive circuit board contains a 12V drive circuit and a 5V drive circuit. These functional power circuits will be described in detail in the following sections.

3. **Rectifier Circuits**
The AC voltage across the secondary winding (P831, pins 1, 3) of the power transformer T802 is bridge-rectified through the rectifier stack D831 to obtain a DC voltage of approximately 19 V. This DC voltage is fed to the 12 V voltage regulator circuit, E12V regulator circuit, and the heater line switching circuit.
The AC voltage across the tertiary winding (square pins 5, 6) is half-wave-recrified through D811 and D812 to obtain a DC voltage of approximately 60 V. This DC voltage is fed to the 47 V voltage regulator circuit.
The obtained 60 VDC voltage is half-rectified through D818 to obtain a DC voltage of approximately –30V.
This DC voltage is fed to the –23V voltage regulator circuit.

4. **E12V Voltage Regulator Circuit**
The main 12 V (ever ON) voltage is made up by E12V regulator circuit consisting of Q829, D836 and D837.
10 V voltage to activate the Timer section is obtained through D823 to D825.

5. **E-23V Voltage Regulator Circuit**
The E-23V voltage regulator circuit consisting of Q813 and D819 produces –23V voltage (ever on).
The –19V voltage is obtained through D821 and D822 and is fed to the center tap (square pin 7) of quarternary winding.

6. **12 V Voltage Regulator**
The 12 V voltage regulator includes two circuits: one, consisting of transistors Q831, Q835, and Q838, zener diode D834, and resistors R835, R851, and R836, which produce the main 12 V regulated power, the second circuit consisting of transistors Q832, Q834, Q835 and Q838, zener diode D834, and resistors R835, R851, and R836, produce the 12 V regulated power for driving the motor. Note that Q831 and Q832 are installed on the heat sink provided outside the PW board to dissipate the generated heat.

7. **5 V Voltage Regulator**
The 5 V voltage is made up by Q837 and D835 from output voltage of main 12 V regulator circuit. Q837 is installed in position on the heat sink provided outside of the PW board to dissipate the generated heat.

8. **47 V Voltage Regulator**
The 47 V voltage regulator circuit, consisting of transistors Q811, zener diode D814, and D815, produces 47 V of regulated power.

9. **Power ON-OFF Control**
The V8600 is normally powered ON or OFF by Q812 which is activated ON or OFF by the POWER/TIMER switch.
When the POWER/TIMER siwtch is in the STANDBY position, the current flows through resistor R813 into the base of Q812, which is turned ON. This prevents the turn ON voltage to be applied to the base of Q811, this preventing the 47 V voltage regulator.
Q835 and Q838 in the 12 V voltage regulator circuit are not biased because these are connected to the 47 V line directly or through R831 and R832. The 12 V also is not supplied to the line.
On the contrary, when the POWER/TIMER switch is in the ON position, current does not flow into the base of Q812, which is turned OFF.
This allows Q811 to be biased.
The 47 V voltage regulator, then, activates to apply the respective regulator biases to Q835, Q837 and Q838.
These transistors activate the respective 12 V and 5 V voltage regulator circuits.
On the other hand, when POWER/TIMER switch is in the TIMER position, the programme timer circuit feeds out signals corresponding to preset times. Each output signal switches Q812 ON or OFF, which turns 47 V, 12 V and 5 V voltage regulator circuits ON or OFF, accordingly.

10. **Heater On-Off Control**
The V8600B has a dew preventive heater installed on the cylinder. When the POWER/TIMER switch is in the OFF position or the cylinder motor is not energized, a voltage of approximately 19 V is applied across the heater. The 19 V voltage is obtained in the manner that current is allowed to the base of a transistor Q842, which turns Q842 on, which at the same time, also turns Q841 on.
On the other hand, when the POWER/TIMER switch is in the ON position or the cylinder motor is running, no bias is applied to Q842, which is turned off and at the same time, also turns Q841 off. This prevents the 19 V volts to be applied to the heater.

11. **Others**
The AC voltage at the secondary winding (P831, pin-3) of the power transformer is rectified through diode D841 to produce a pulsating current, which is supplied to the dew sensor circuit.
Also, the AC voltage at the quinary winding (square pins 8 and 9) is directly supplied to the Program Timer Circuit as filament voltage.
When POWER/TIMER switch is turned ON, E12V voltage is supplied for a muting. While POWER/TIMER switch is in the OFF position, current flows into the base of Q843 through R847, which turns ON to connect E12V output to the ground through R846. When switch is in the ON position, current does not flow into the base of Q843, which turns OFF. This allows to supply E12V voltage through R846.

SECTION 4 ELECTRICAL ADJUSTMENT

GENERAL
The information contained in this section does not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with electrical adjustment. Should further information be desired or should particular problems arise which are not covered sufficiently for the servicing purposes, the matter should be referred to the Toshiba Corporation.

ALIGNMENT AND ELECTRICAL ADJUSTMENT
All the alignment of this machine can be performed by the procedure using the equipment mentioned below and the TV signal obtained from a TV receiver (an exclusive console or a monitor TV).

Instruments and Tools Required
1. Color TV receiver
2. Dual-trace oscilloscope having 10 MHz or more bandwidth
3. Color-bar generator (A rainbow type is impractical.)
4. Frequency counter
5. VTVM
6. VOM (200 kΩ/V)
7. Audio oscillator
8. Audio attenuator
9. KR5-1C alignment tape (Part No. 70909032)
10. Alignment jigs and tools, 1 set

Set-up Procedures (see Fig. 2-1)
1. Connect the TV set to the AERIAL OUT and AERIAL IN terminal on the rear panel of the VTR as illustrated in page (Item 1-3 CONNECTIONS).
2. Set the VTR to the channel at which the TV reception is best.
3. Make certain that the video input signal is around 0.7 Vp-p with an oscilloscope connected.
4. Also, make certain that the sync signal level is around 0.3 Vp-p.
5. Tune the Varactor Tuner into the channel received so that the burst level is around 0.3 ± 0.1 Vp-p, while observing the picture on the TV screen.
6. Make certain that no spikes can be seen on any sync pulse.

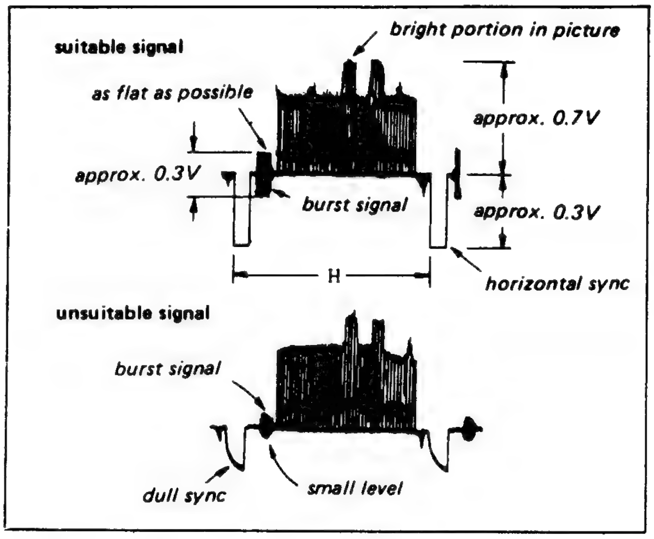


Fig. 4-1 TV Video Output Signal

The suitable output waveform of the color-bar signal generator is shown in Fig. 4-2.

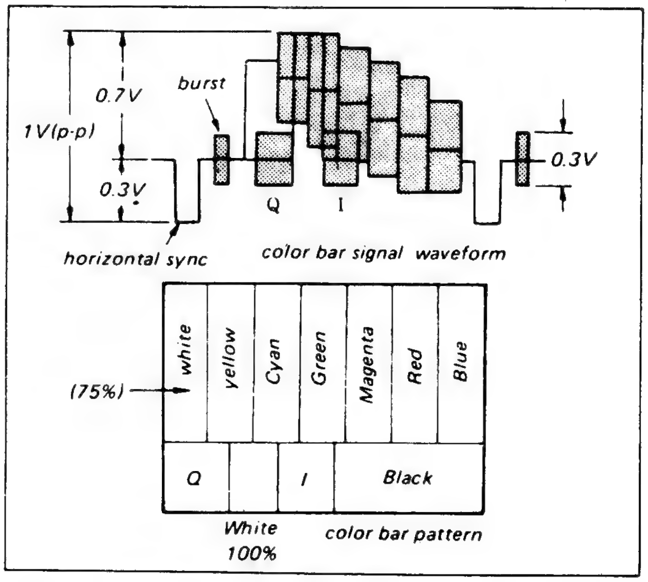
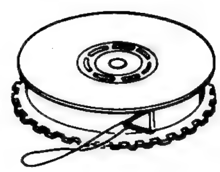


Fig. 4-2 75% Color Bar Signal Recorded on the Alignment Tape

TOOL AND JIGS REQUIRED

NAME	CODE NO.	JIG NO.	QTY	SKETCH NO.	REMARK
Forward Back-Tension Measurement Jig Fixture	70909025	SL-0002	1	1	○
T type Torque Measurement Cassette	70909031	SL-0003	1	2	x
R-F type Torque Measurement Cassette	70909030	SL-0004	1	2	x
Forward Tension Alignment Jig	70909005		1	3	○
Tension Bracket 2	70909061		1	4	○
Loading Ring Clearance Gauge	70909018	SL-0007	1	5	○
Cassette Reference Plate	70909019	SL-0008	1	6	○
Tape Guide Adjustment Jig	70909036		1	7	○
Rotating Head Disk Alignment Jig Fixture (Eccentricity Gauge)	70909021	SL-0012	1	8	○
Capstan FG Adjustment Jig, Plate (PAL)	70909066		1	12	○
Capstan FG Adjustment Jig, Shaft (PAL)	70909067		1	9	○
Tension Gauge (Max. 100g)	70909024		1	10	○
Tension Gauge (Max. 200g)	70909012		1	10	x
Tension Gauge (Max. 500g)	70909029		1	10	○
Dental Mirror	70954001		1	11	○
Alignment Tape (KR5-1C)	70909032		1		○
Oil Injection Kit	70956001		1		○

Note: ○ . . . Indispensable tool x . . . Not indispensable tool

①


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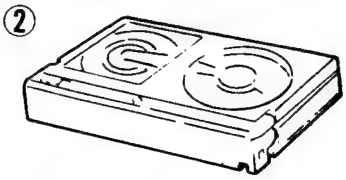

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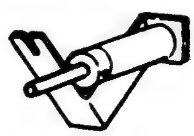

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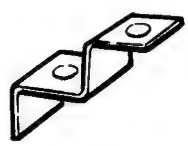

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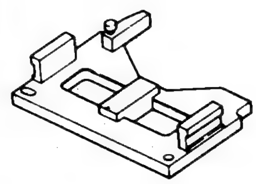

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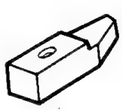

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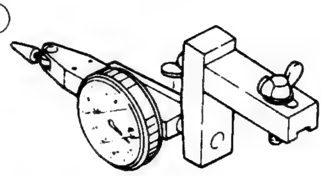

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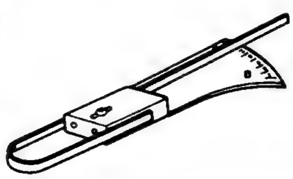

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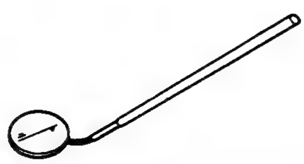

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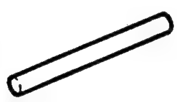
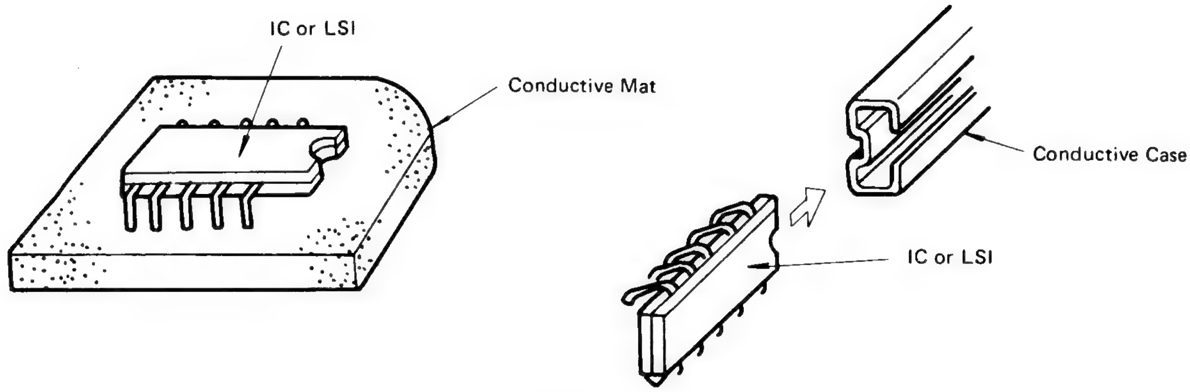


SERVICING

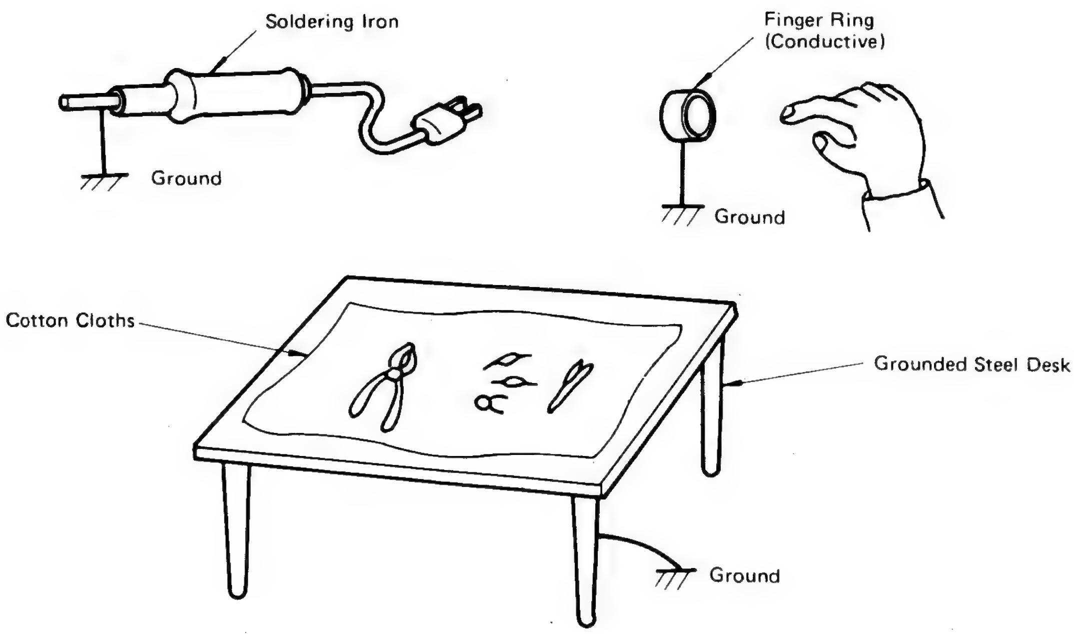
Service Precautions

IC's and LSI's are subject to damage from static electricity.
Service with the following precautions.

(1) Stock IC's and LSI's in conductive mats or cases.
(2) Handle the parts after grounding of working bench, human body, tools etc.
(3) Recommended working mat: Cotton cloths
(4) Recommended working bench: Grounded steel desk (See below)



Methods of Stocking IC's or LSI's



Methods of Grounding Servicing Desk

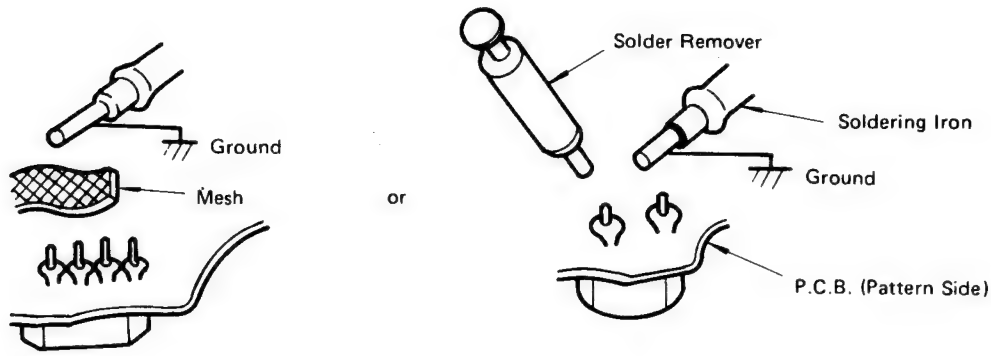
Desoldering and Soldering of Parts

Tools:

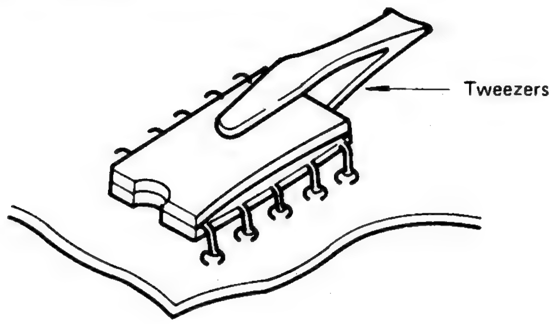
(1) Soldering iron (30 watts grounded)
(2) Desoldering mesh or solder remover.
(3) Tweezers
(4) Solder with inner flux.
(5) Wire cutting tool

Procedure:

(a) Desolder all pins of a defective part using the desoldering mesh.



(b) Remove the desoldered parts from P.C.B. using tweezers.



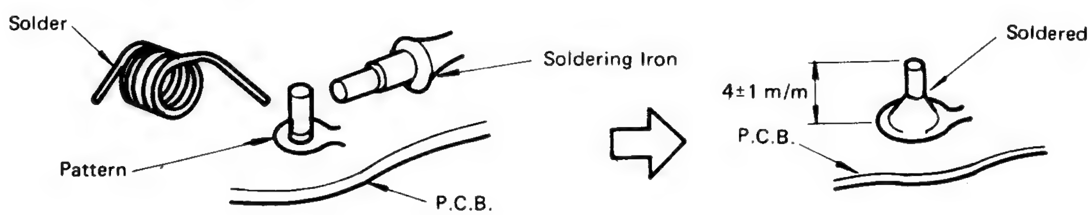
(c) Place a new part into P.C.B.

CAUTION: Before inserting new part, note the polarity of capacitor diode and pin number of IC or LSI.

(d) Warm the pin of parts and pattern on P.C.B. using the soldering iron.

CAUTION: This maximum warming time is 1 second.

(e) Solder within 5 seconds.

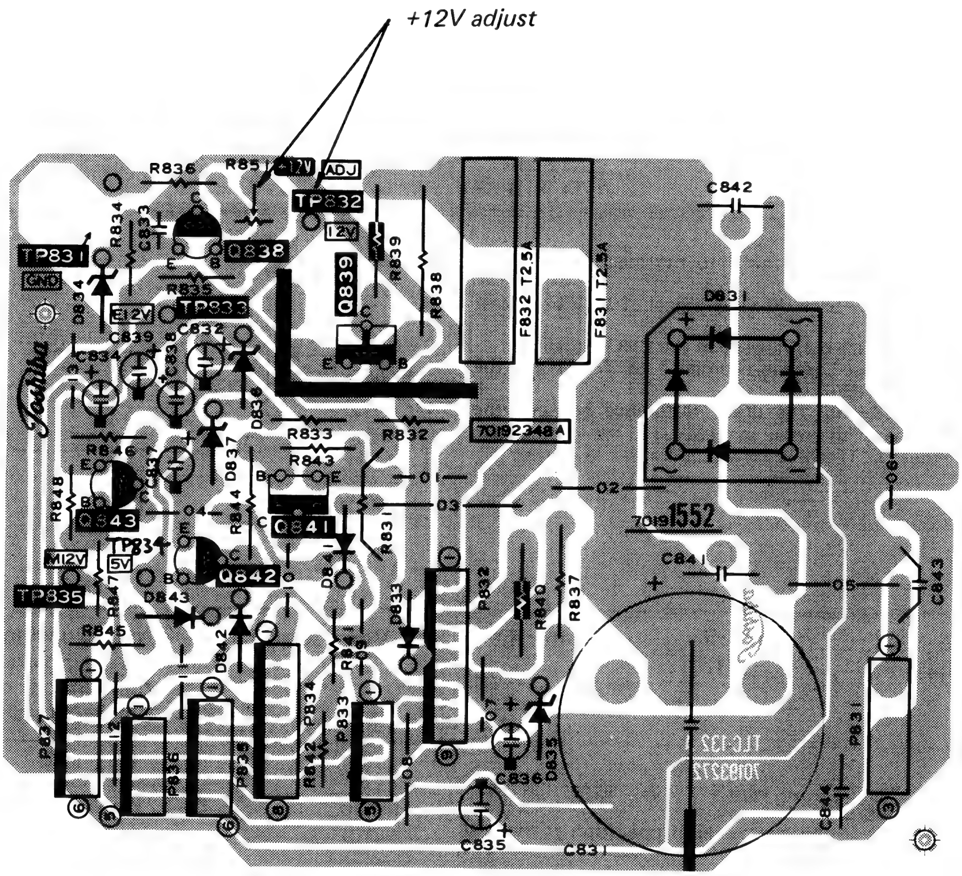


(f) Cut the wire lead as shown in above figure.

CAUTION: Check the soldered portion. If it is poor or solder-bridge, solder again.

4-1 POWER SUPPLY CIRCUIT ADJUSTMENT METHOD

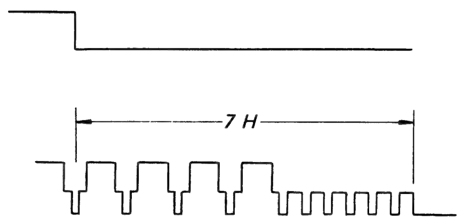
No.	Item	ADJ location	Checking point	Measuring instrument	Reading
1	12 V adjustment	R851	TP832 TP831 (GND)	DC voltmeter	12 V ± 0.05 V
	(1) Turn POWER switch on. (2) Connect positive probe of DC voltmeter to TP832 and GND probe to TP831. (3) Adjust R851 to maintain that DC voltmeter indicates 12 ± 0.05 V.				



4-2 SERVO LOGIC CIRCUIT ADJUSTMENT METHOD

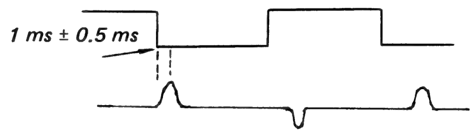
No.	Item	ADJ location	Checking point	Measuring instrument	Reading
1	Video head switching position (playback phase)	R551 (PG1) R552 (PG2)	TP501 (RE SW PULSE) TP203 (VIDEO signal)	Oscilloscope (dual trace)	7 H ± 2 H before leading edge of vertical sync pulse (both A and B fields)

(1) Play back the color bar section of the alignment tape.
(2) Set the dual-trace oscilloscope in the CHOP mode, the sweep time to 100 μsec/cm or less, and in external triggering from TP501.
(3) Connect the oscilloscope channel 1 to the VIDEO LINE OUT terminal, or to TP203 on the VIDEO Circuit board, and the channel 2 to TP501 on the Servo Circuit board.
(4) Count the number of H cycles, or of the horizontal sync pulses, as measured from the leading edge of the vertical sync signal to the trailing edge of the switching pulse.
(5) Adjust R551 for the positive external trigger until the oscilloscope shows 7 H ± 2H cycles before the vertical sync pulse.
(6) Also, adjust R552 for the negative external trigger until the oscilloscope shows 7 H cycles before the vertical sync pulse.



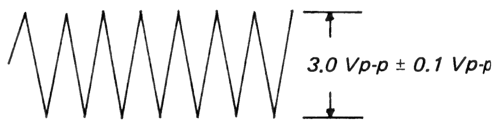
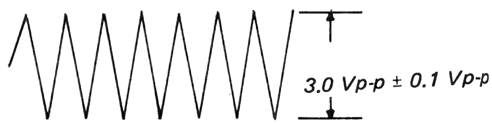
No.	Item	ADJ location	Checking point	Measuring instrument	Reading
2	Tracking center alignment	R553 (TRACKING)	TP501 (SW PULSE) TP514 (CTL PULSE)	Oscilloscope (dual trace)	1 ms ± 0.5 ms

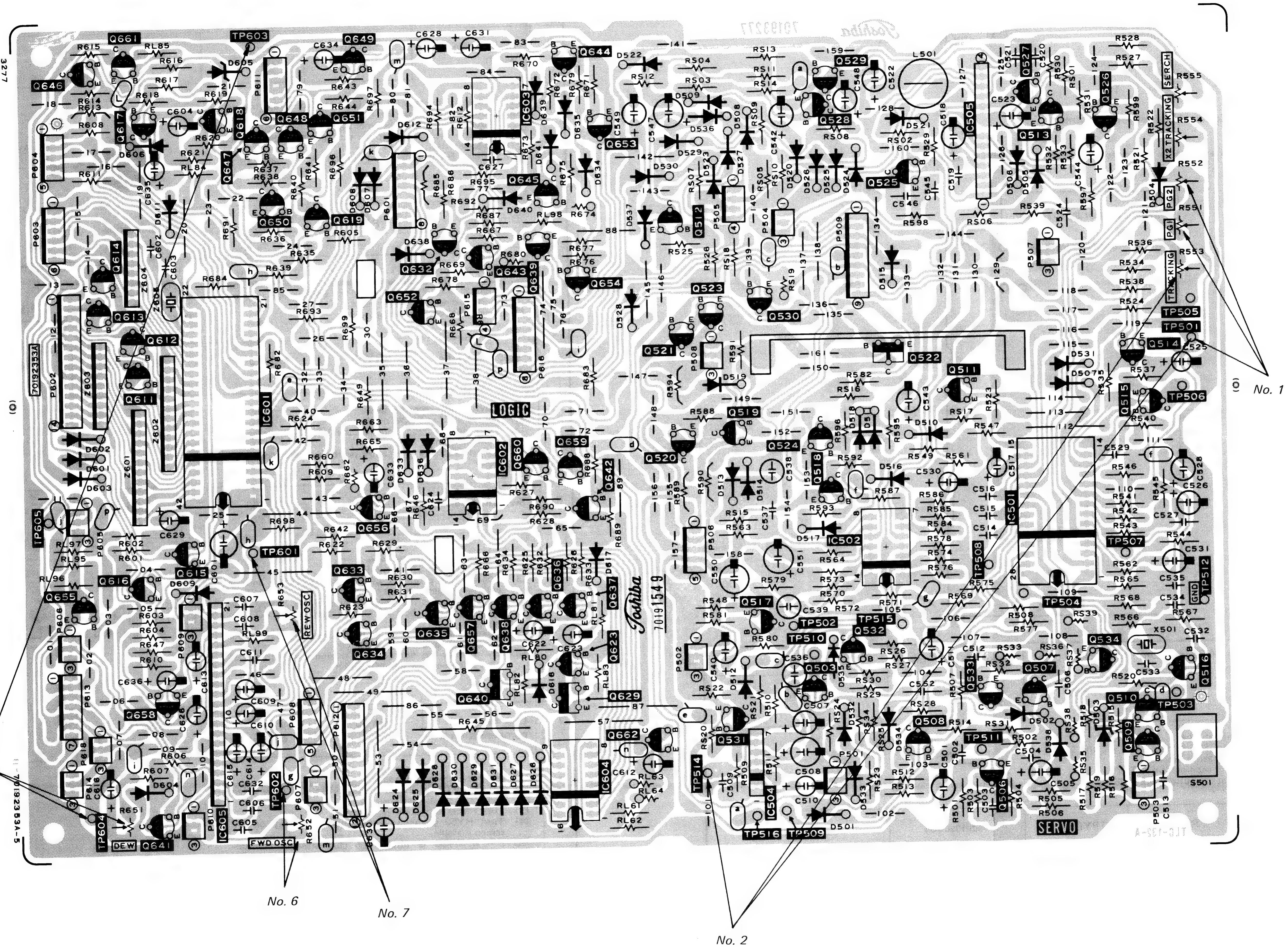
(1) Set the TRACKING control to the mechanical center where it clicks.
(2) Record and play back the video signal of a TV broadcast station.
(3) Set the dual-trace oscilloscope in the CHOP mode.
(4) Connect the oscilloscope channel 1 to TP501 and the channel 2 to TP514.
(5) Adjust R553 until the phase difference between the trailing edge of the pulse at TP501 and the leading edge of the pulse at TP502 is 1 msec ±0.5 msec as shown.



No.	Item	ADJ location	Checking point	Measuring instrument	Reading
3	Picture Serch f_H	R555 (FH)	Monitor TV	Visual checking	Normal playing back picture during picture search operation without out of horizontal synchronization phase.

(1) Playback the tape on which a video signal has been correctly recorded.
(2) Set the VTR in the cue mode of operation at the low speed.
(3) Adjust R555 so that the played back picture is in around the center of screen without having out of horizontal synchronization phase.
(4) Confirm that played back picture is normally appeared on the screen during review mode at low speed and cue/review mode at high speed.
(5) Check whether the difference between the luminance and colour signals on the played back picture is not appeared when playing back the colour bar section of Alignment tape.
If difference appears, adjust R555 until it may go off.

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
4	Tracking center during double speed	R554	Monitor TV screen	Visual checking	No noise
	(1) Playback the tape on which has been correctly recorded by returned VTR and set the TRACKING knob to the mechanical center where it clicks. (2) Set the VTR into Double speed playback mode. (3) Adjust R554 until the Noise may go off on the played back picture.				
5	Dew sensitivity checking	R651	TP603 (GND) TP604	Visual checking	Activated by 47 kΩ and released by 150 kΩ.
	(1) Adjust R651 so that the DEW LED on the operating board can illuminate when a 47 kΩ resistor is connected between TP603 and TP604. (2) Make certain that the DEW LED goes out when a 150 kΩ resistor is connected between TP603 and TP604. (3) If not, be sure to carry out No. 1 adjustment again. CAUTION: Be careful not to make open between TP603 and TP604 when switching to the 150 kΩ resistor, as the dew sensing circuit has hysteresis characteristic.				
6	Forward oscillation level	R652	TP602	Oscilloscope	3.0 Vp-p ± 0.1 Vp-p
	(1) Set up the VCR in the playback mode of operation. (2) Connect the oscilloscope to TP602. (3) Adjust R652 until the oscillation level is 3.0 Vp-p ± 0.1 Vp-p.  				
7	Rewinding oscillation level	R653	TP601	Oscilloscope	3.0 Vp-p ± 0.1 Vp-p
	(1) Set up the VCR in the rewinding mode of operation. (2) Connect the oscilloscope to TP601 (3) Adjust R653 until the oscillation level is 3.0 Vp-p ± 0.1 Vp-p.  				


No. 1
No. 2
No. 5
No. 6
No. 7
LOGIC
SERVO

4-3 SERVO II ADJUSTMENT METHOD

Preliminary steps

(1) Remote control hand unit (for adjustment) without detect terminal and tracking VR.

(2) Test tape

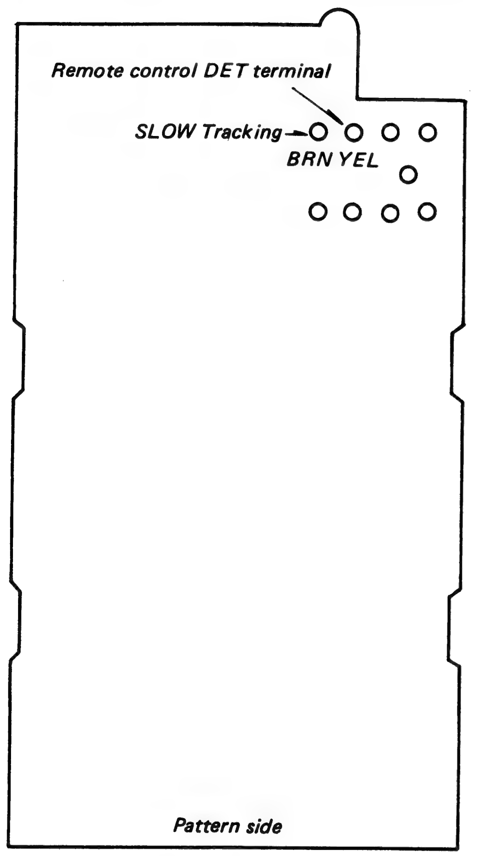
- Colour bar test tape with 2.5 KHz Audio signal — 1 pc
- Blanking tape — 1 pc

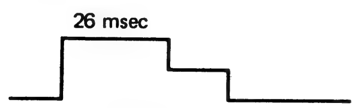
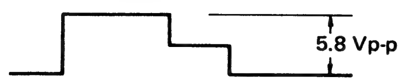
(3) Oscilloscope (dual trace type)

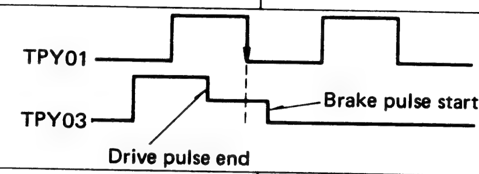
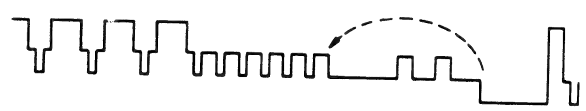
(4) Monitor television set

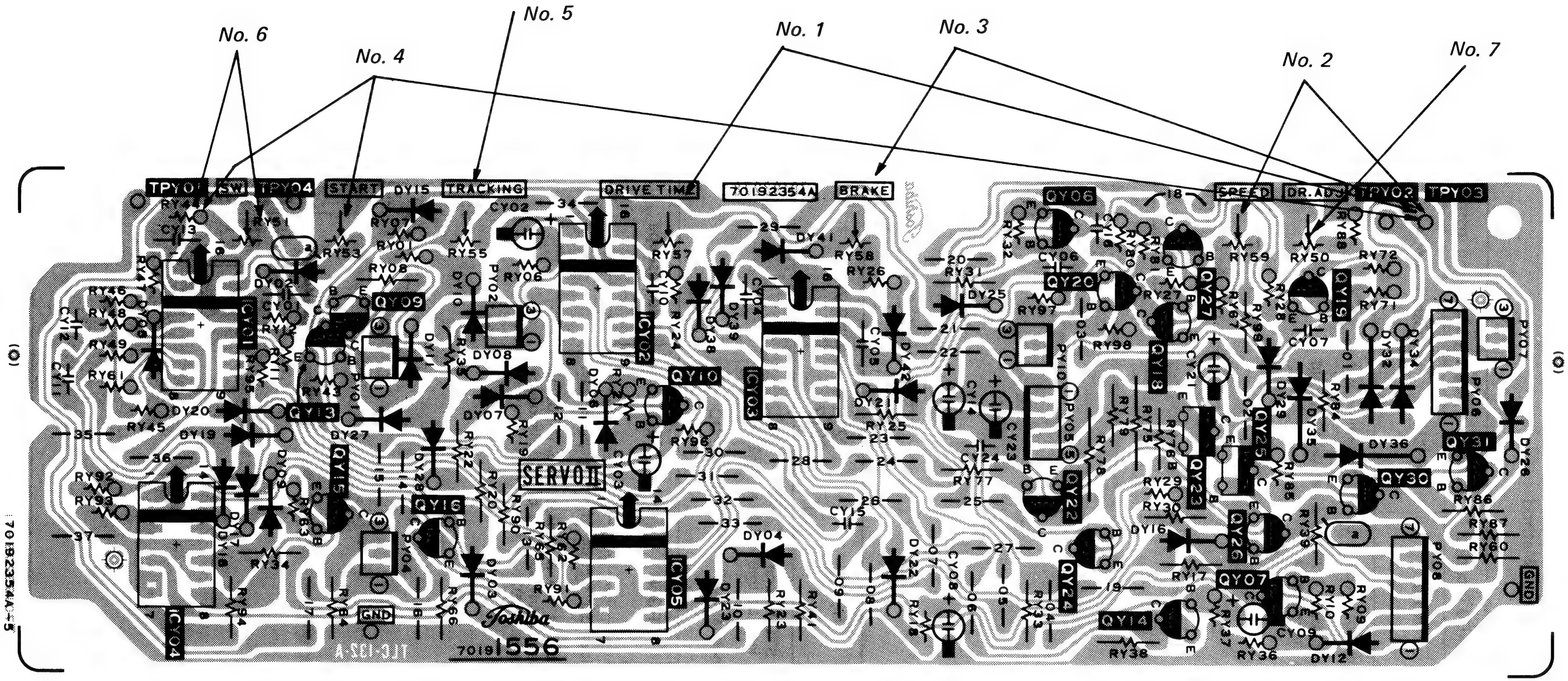
Modification of Remote Control hand set for Adjustment

(1) Remove the Cover.
(2) Disconnect the yellow lead wire and the Brown lead wire from circiut Board as shown below.



No.	Item	ADJ location	Checking point	Measuring instrument	Reading
1	Drive pulse width	RY57	TPY03	Oscilloscope	26 msec
	(1) Playback the alignment tape. (2) Set up the VTR in SLOW mode and set the SLOW speed control to the fastest position. (3) Connect the probe of oscilloscope to TPY03. (4) Adjust RY57 so that the pulse width is 26 ms.				
2	Drive pulse voltage	RY59	TPY03	Oscilloscope	5.8 Vp-p
	(1) Proceed with steps (1) and (2) in the No. 1 adjustment. (2) Adjust RY59 so that the waveform is 5.8 Vp-p.				

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
3	Brake pulse width	RY58	TP708 TPY03	Oscilloscope	Minimum
	(1) Proceed with steps (1) and (2) in the No. 1 adjustment. (2) Connect the probe of oscilloscope to TP708 on the Audio board and its external trigger terminal to TPY03. (3) Set the oscilloscope so it is triggered to the leading edge of pulse. (4) Adjust RY58 until the portion A of waveform is minimum.				
4	Drive pulse start position	RY53	TPY01 TPY03	Oscilloscope	as shown below
	(1) Proceed with steps (1) and (2) in the No. 1 adjustment. (2) Connect the oscilloscope channel A to TPY03 and channel B to TPY01 and set the oscilloscope in chop mode and normal trigger mode. (3) Adjust RY53 as shown below.				
5	SLOW tracking center	RY55	Monitor TV	Visual check	No noise condition
	(1) Playback self-recorded tape. (2) Set the VTR in SLOW mode. (3) Turn the Tracking knob on the VTR body to center click position. (4) Adjust RY55 to the center position where there is no noise.				
6	Switching pulse	RY51	TP203 TPY01	Oscilloscope	as shown below
	(1) Playback self-recorded tape. (2) Set the VTR in STILL mode. (3) Connect the probe of oscilloscope to TP203 and its external trigger terminal to TPY01. (4) Adjust RY51 so that the beginning of the vertical sync signal coincides the beginning of the Pseudo VD sync signal. (5) Make certain that they coincide when triggered to the leading edge and trailing edge. NOTE:– If they do not coincide, readjust adjustment of video head switching position.				
7	Disk motor compensation	RY50	Visual checking	TV screen	as described below
	(1) Playback self-recorded tape. (2) Set the VTR in SLOW mode and set the slow speed control to the fastest position. (3) Turn RY50 fully counterclockwise. (4) Turn RY50 gradually clockwise until picture on TV screen is stable. NOTE:– If RY50 is turned too clockwise (or counter-clockwise), picture on TV screen will disort horizontally.				

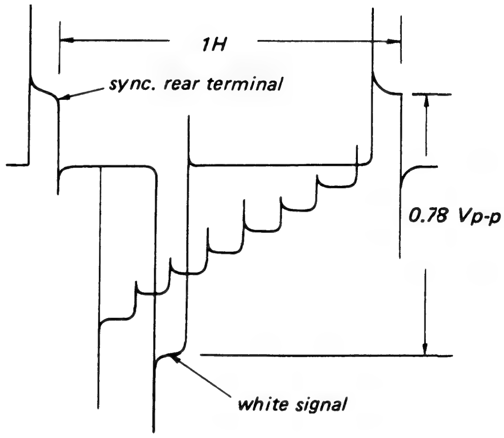
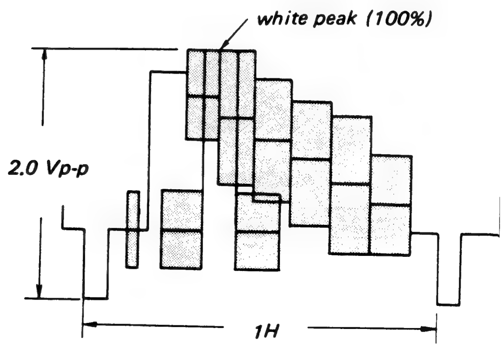


No. 6
No. 4
No. 5
No. 1
No. 3
No. 2
No. 7
TPY01
SW
TPY04
START
TRACKING
DRIVE TIME
70192354A
BRAKE
SPEED
DR. ADJ
TPY02
TPY03
SERVO II
GND
Toshiba
70191556
TLC-132-A

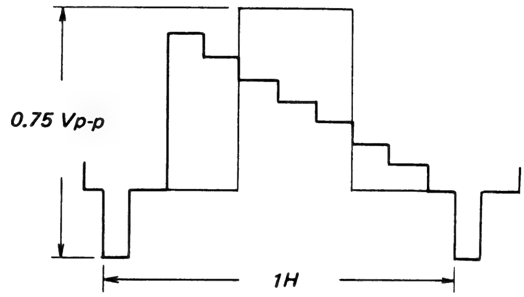
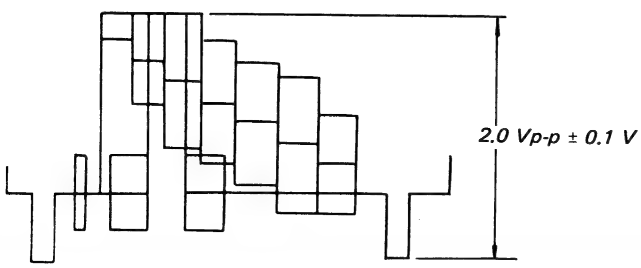
4-4 VIDEO (I) ADJUSTMENT METHOD

Luminance Circuit Adjustment Method

Playback mode

<table>
<tr><th>No.</th><th>Item</th><th>ADJ location</th><th>Checking point</th><th>Measuring instrument</th><th>Reading</th></tr>
<tr><td rowspan="2">1</td><td>De-emphasis</td><td>R358</td><td>TP207</td><td>Oscilloscope</td><td>0.78 Vp-p between sync-tip and white peak</td></tr>
<tr><td colspan="5">(1) Playback the colour bar section of the Alignment test tape.
(2) Adjust R358 to maintain 0.78 Vp-p between sync-tip and white peak as shown below.

</td></tr>
<tr><td rowspan="2">2</td><td>Expand</td><td>R357</td><td>TP216
TP217</td><td>VTVM</td><td>0.2 V_{DC} between TP216 and TP217</td></tr>
<tr><td colspan="5">(1) Set the VTR into STOP mode.
(2) Connect the + lead of the VTVM to TP216 and − lead to TP217.
(3) Adjust R357 to maintain VTVM reading 0.2 V_{DC}.</td></tr>
<tr><td rowspan="2">3</td><td>Playback Y signal output</td><td>R356</td><td>TP203</td><td>Oscilloscope</td><td>2 Vp-p</td></tr>
<tr><td colspan="5">(1) Playback the colour bar section of the alignment test tape.
(2) Connect the probe of the oscilloscope to TP203 and adjust R356 to maintain 2.0 Vp-p of the playback Y signal output level at TP203.

</td></tr>
</table>

Recording mode

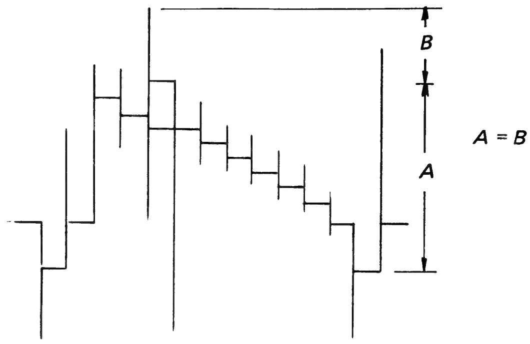
<table>
<tr><th>No.</th><th>Item</th><th>ADJ location</th><th>Checking point</th><th>Measuring instrument</th><th>Reading</th></tr>
<tr><td rowspan="2">1</td><td>Setting Y signal level</td><td>R351</td><td>TP215</td><td>Oscilloscope</td><td>0.75 Vp-p</td></tr>
<tr><td colspan="5">(1) Supply the colour bar signal to VIDEO IN terminal of the VTR and set the INPUT select switch to the line side.
(2) Set the VTR to the STOP mode.
(3) Connect the probe of the oscilloscope to TP215 and adjust R351 to maintain 0.75 Vp-p between sync-tip and white peak as shown below.
CAUTION: Confirm the input signal level at TP201 to be 1.0 Vp-p between sync-tip and white peak before this adjustment.

</td></tr>
<tr><td rowspan="2">2</td><td>Sync-tip carrier frequency setting</td><td>R354</td><td>TP202</td><td>Frequency counter</td><td>3.85 ± 0.05 MHz</td></tr>
<tr><td colspan="5">(1) No input state.
(2) Connect the frequency counter to TP202 and adjust R354 to maintain the frequency counter reading 3.85 ± 0.05 MHz.</td></tr>
<tr><td rowspan="2">3</td><td>Compress</td><td>R353</td><td>TP212
TP213</td><td>VTVM</td><td>D_C voltage between TP212 and TP213 is 0.2V.</td></tr>
<tr><td colspan="5">(1) No input state and set the VTR to STOP mode.
(2) Connect the ⊕ lead of VTVM to TP212 and the ⊖ lead to TP213.
(3) Adjust R353 to maintain 0.2 V_{DC} of VTVM reading.</td></tr>
<tr><td rowspan="2">4</td><td>FM deviation</td><td>R351</td><td>TP203</td><td>Oscilloscope</td><td>2.0 Vp-p ± 0.1 V</td></tr>
<tr><td colspan="5">* The playback Y signal output level must be set to 2.0 Vp-p previously. Refer to No. 3 Playback Y signal output adjustment.
(1) Supply the colour bar signal to VIDEO IN terminal of the VTR and set the Input select switch to line side.
(2) Connect the probe of the oscilloscope to TP203.
(3) Record and Playback.
(4) Adjust R351 in the recording mode to maintain 2.0 Vp-p ± 0.1 V of the playback level as same as the No. 3 Playback Y signal output adjustment.

</td></tr>
</table>

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
5	White clip	R352	TP206	Oscilloscope	same level (A = B)

(1) Supply the colour bar signal to video in terminal of the VTR and set the input select switch to the line side.

(2) Set the VTR in STOP mode.

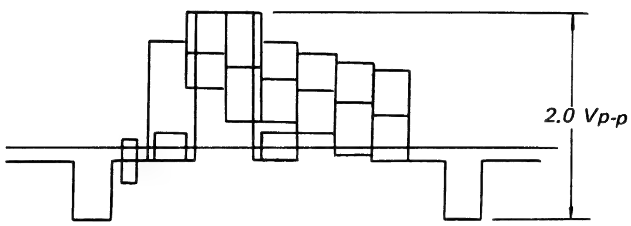
(3) Adjust R322 so that A (from sync-tip to white peak) level is the same as B (overshoot) level.



6	E-E output level	R350	TP203	Oscilloscope	2.0 Vp-p

(1) Supply the colour bar signal to the VIDEO IN terminal of the VTR and set the VTR to STOP mode.

(2) Connect the probe of the oscilloscope to TP203 and adjust R350 to maintain 2.0 Vp-p of the Video signal level as shown below.

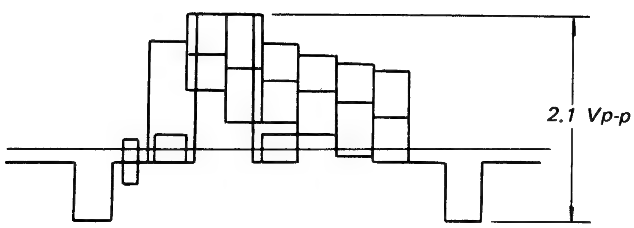


7	Peak AGC	R451	TP203	Oscilloscope	2.1 Vp-p

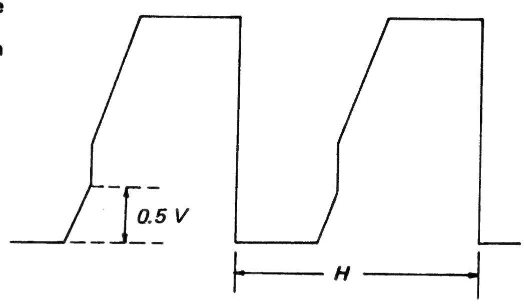
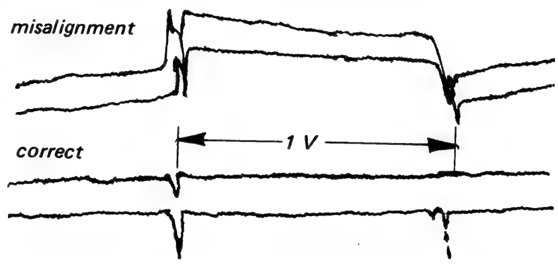
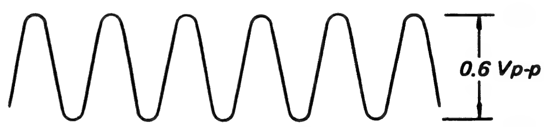
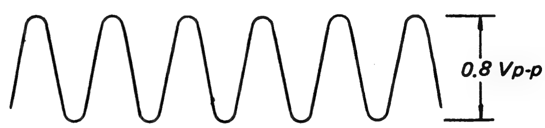
(1) Receive the on-air TV signal, and set the INPUT select switch to TV side and the VTR to STOP mode.

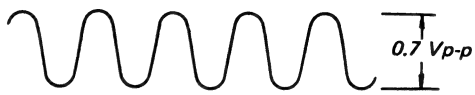
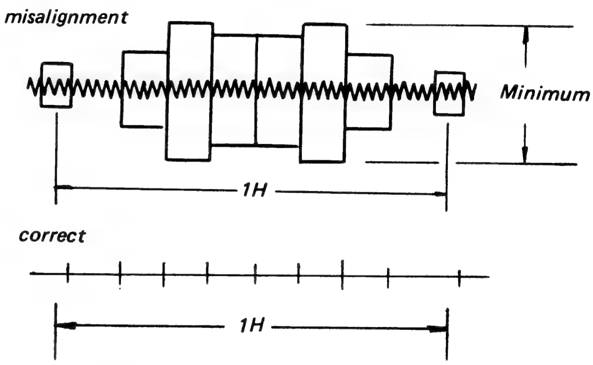
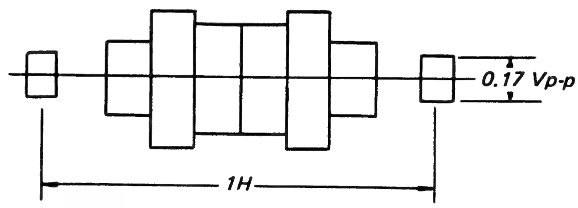
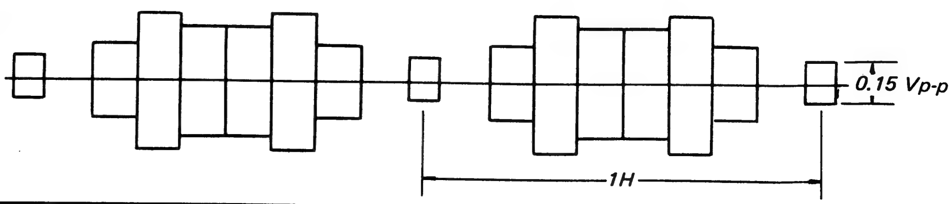
(2) Tune out the tuning of the VTR tuner to change the V/S ratio.

(3) Connect the probe of the oscilloscope to TP203 and adjust R451 until the 100% white peak level measured from the sync-tip is 2.1 Vp-p as shown below.



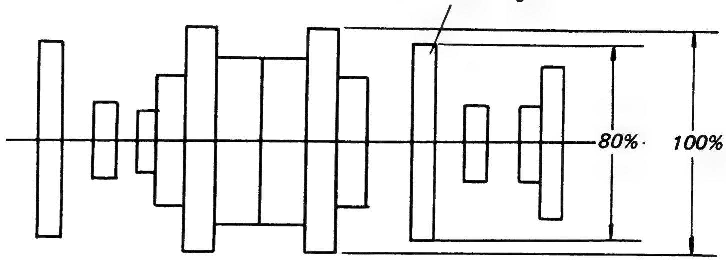
4-5 COLOUR CIRCUIT ADJUSTMENT METHOD

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
1	AFC	R257	TP-223	Oscilloscope	As shown below.
	(1) Supply the colour bar signal to the VIDEO LINE IN terminal and set the input selector switch to the LINE side. (2) Set the VTR to the stop mode. (3) Connect the probe of the scope to TP-223 and set the time base at 20 μS/div. (4) Adjust R257 (AFC) to maintain the static waveform as shown in the Fig. below.				
2	AFC off-set	R258	TP224	Oscilloscope	as shown below.
	(1) Supply the colour bar signal to the VIDEO LINE IN terminal and set the Input select switch to the LINE side. (2) Set the VTR to the RECORD mode with a cassette inserted. (3) Connect the probe of the oscilloscope to TP224 and adjust R258 to maintain the static waveform to be flat level as shown below.				
3	4.43 MHz VXO	T253	TP211	Frequency counter	4.433619 MHz ± 20 Hz
	(1) No input state and set the VTR to the STOP mode. (2) Connect the Frequency counter to TP211 and adjust the core of T253 to maintain 4.433619 MHz ± 20 Hz of a frequency counter reading.				
4	4.43 MHz XO	T252	TP211	Frequency counter	4.433619 MHz ± 20 Hz
	(1) Playback the colour bar section of the alignment test tape. (2) Connect the frequency counter to TP211 and adjust the core of T252 to maintain 4.433619 MHz ± 20 Hz of a frequency counter reading.				

<table>
<tr><th>No.</th><th>Item</th><th>ADJ location</th><th>Checking point</th><th>Measuring instrument</th><th>Reading</th></tr>
<tr><td rowspan="2">5</td><td>5.12 MHz CW</td><td>T201</td><td>TP219</td><td>Oscilloscope</td><td>Maximum level of 5.12 MHz CW</td></tr>
<tr><td colspan="5">(1) Supply the colour bar signal to the VIDEO LINE IN terminal of the VTR and set the VTR to STOP mode.
(2) Connect the probe of the oscilloscope to TP219 and adjust the core of T201 to maintain the maximum level of 5.12 MHz continuous waveform as shown below.
</td></tr>
<tr><td rowspan="2">6</td><td>Comb Filter</td><td>R253
L251</td><td>TP209
TP220</td><td>Oscilloscope</td><td>Minimum level of the chroma signal</td></tr>
<tr><td colspan="5">(1) Supply the colour bar signal to the VIDEO LINE IN terminal of the VTR and set the VTR to STOP mode.
(2) Connect the probe of the oscilloscope to TP209 and adjust R251 to maintain the Burst level to be around 0.2 Vp-p.
(3) Connect the probe of the oscilloscope to TP220 and adjust R253 and L251 to maintain the minimum level of the chroma signal as shown below.
</td></tr>
<tr><td rowspan="2">7</td><td>ACC set</td><td>R251
T251</td><td>TP209</td><td>Oscilloscope</td><td>0.17 Vp-p of the burst signal level</td></tr>
<tr><td colspan="5">(1) Supply the colour bar signal to the VIDEO LINE IN terminal of the VTR and set the VTR to STOP mode.
(2) Connect the probe of the oscilloscope to TP209 and adjust the core of T251 to maintain the burst signal level to be minimum.
(3) Then, adjust R251 to maintain 0.17 Vp-p of the burst signal level.
</td></tr>
<tr><td rowspan="2">8</td><td>Record chroma level</td><td>R254</td><td>TP208</td><td>Oscilloscope</td><td>0.15 Vp-p of the burst signal level</td></tr>
<tr><td colspan="5">(1) Proceed with step (1) in the No. 7 adjustment above.
(2) Connect the probe of the oscilloscope to TP208 and adjust R254 to maintain 0.15 Vp-p of the burst signal level as shown below.
</td></tr>
</table>

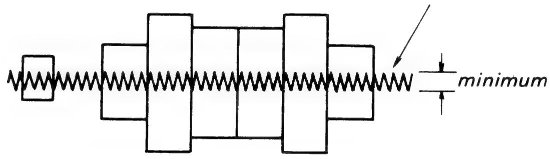
No.	Item	ADJ location	Checking point	Measuring instrument	Reading
9	Pilot burst level	R256	TP208	Oscilloscope	as shown below.

(1) Proceed with step (1) in the No. 7 adjustment above.
(2) Set the VTR to the stop mode.
(3) Connect the probe of the oscilloscope to TP208 and adjust R256 to maintain as shown below.



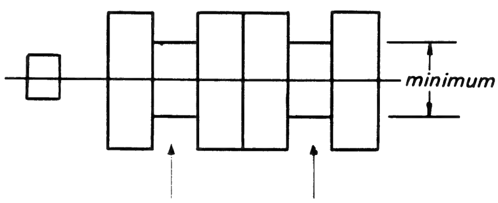
No.	Item	ADJ location	Checking point	Measuring instrument	Reading
10	5.12 MHz carrier balance	R252	TP210	Oscilloscope	Minimum carrier leak of 5.12 MHz

(1) Supply the colour bar signal to the VIDEO LINE IN terminal of the VTR and set the VTR to STOP mode.
(2) Connect the probe of the oscilloscope to TP210 and adjust R252 to maintain the minimum carrier leak of 5.12 MHz as shown below.



No.	Item	ADJ location	Checking point	Measuring instrument	Reading
11	1H Delay	L252 R255	TP222 TP221	Oscilloscope	As shown below.

(1) Supply the colour bar signal to the Video Line in terminal of the VTR and set the VTR in STOP mode.
(2) Connect the CH-1 probe of the oscilloscope to TP221 and CH-2 probe to TP222.
(3) Set the oscilloscope to ADD (Addition) mode.
(4) Adjust R255 and L252 to maintain the minimum of the added chroma signal level as shown below.



No.	Item	ADJ location	Checking point	Measuring instrument	Reading
12	Test signal oscillation frequency	R359	TP218	Frequency counter	15.625 kHz ± 50 Hz

(1) Turn the Test signal switch ON.
(2) Connect the frequency counter to TP218 and adjust R359 to maintain 15.625 kHz ± 50 Hz of the frequency counter reading.

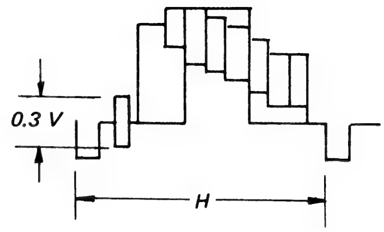
No.	Item	ADJ location	Checking point	Measuring instrument	Reading
13	Colour mix	R251 (ACC set)	TP203	Oscilloscope	0.3 Vp-p of the burst signal level.

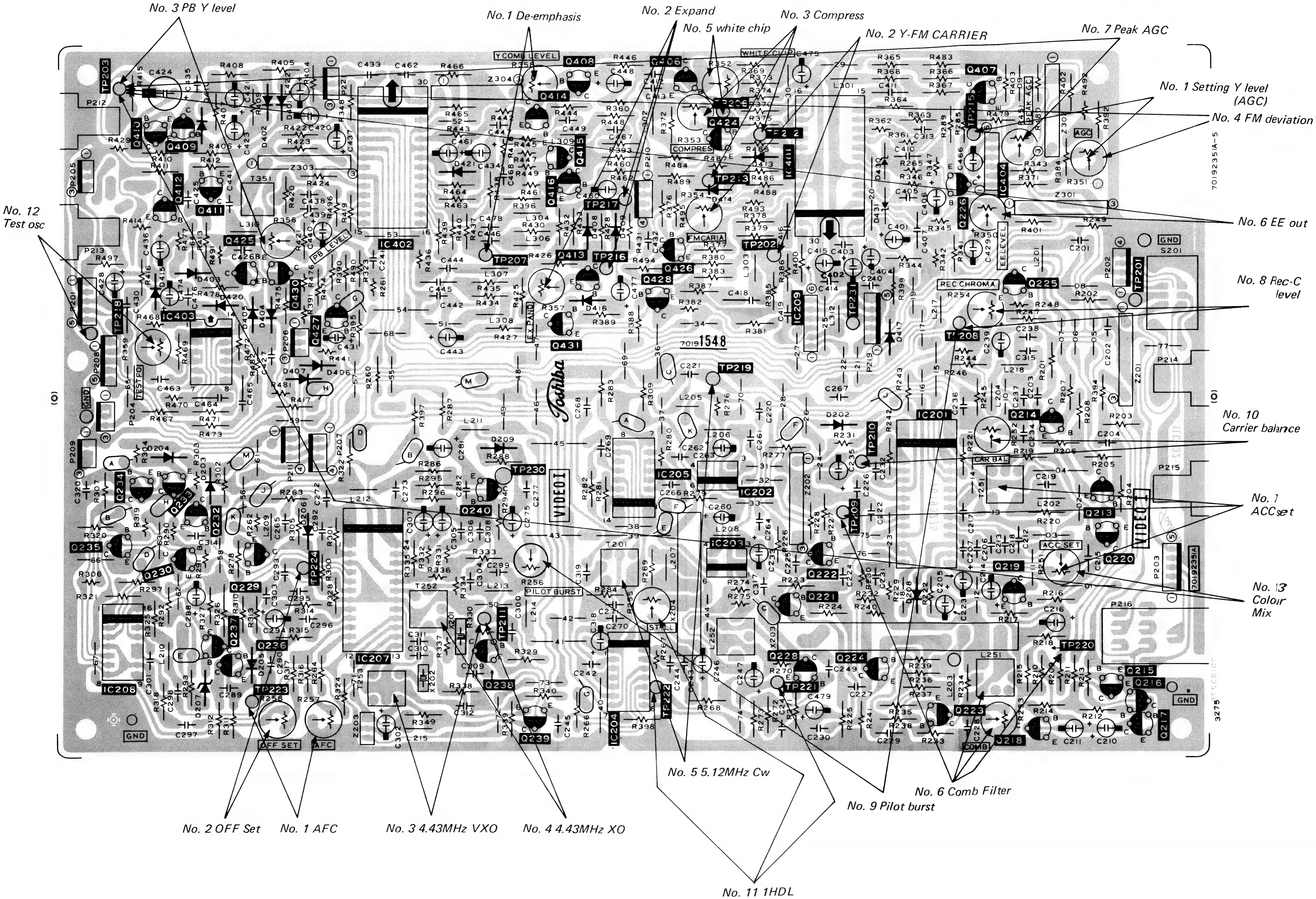
▪ **CAUTION:** When the output level of colour burst signal is more or less than 0.3 Vp-p in playback mode, adjust the colour burst level according to the follows.

(1) Playback the colour bar section of the alignment test tape.

(2) Connect the probe of the oscilloscope to TP203 and adjust R251 to maintain that the colour burst level is 0.3 Vp-p.

(3) Readjust the REC chroma level as described in No. 8 Record chroma level.





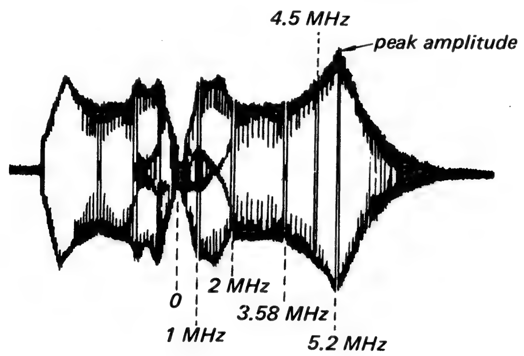
No. 3 PB Y level
No. 1 De-emphasis
No. 2 Expand
No. 5 white chip
No. 3 Compress
No. 2 Y-FM CARRIER
No. 7 Peak AGC
No. 1 Setting Y level (AGC)
No. 4 FM deviation
No. 12 Test osc
No. 6 EE out
No. 8 Rec-C level
No. 10 Carrier balance
No. 7 ACCset
No. 13 Colour Mix
No. 5 5.12MHz Cw
No. 6 Comb Filter
No. 9 Pilot burst
No. 2 OFF Set
No. 1 AFC
No. 3 4.43MHz VXO
No. 4 4.43MHz XO
No. 11 1HDL

4-6 PRE-AMPLIFIER ADJUSTMENT

Pre amplifier circuit adjustment method

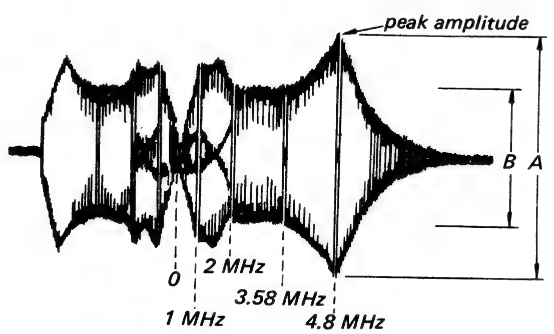
No.	Item	ADJ location	Checking point	Measuring instrument	Reading
1	Pre-set	R151 R152 R153 R154			Turn volumes of R151 through R154 fully counterclockwise as looked toward the top of the shield case.
2	Resonance freq. A-HEAD B-HEAD	C151	TP101 (TRIG:TP103)	Oscilloscope	5.2 MHz $^{+0.2\ MHz}_{-0.1\ MHz}$ resonant

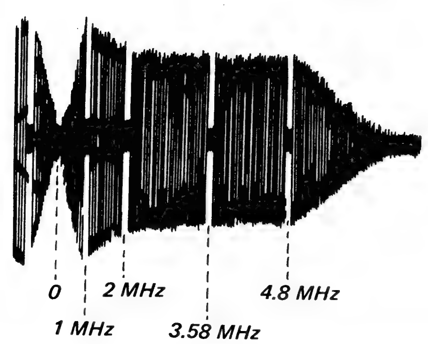
(1) Play back the RF sweep signal of the alignment test tape.
(2) Turn playback frequency response A (R156) and B (R155) fully clockwise as viewed from the top side.
(3) Connect the probe of the oscilloscope to TP101 and the trigger input to TP103.
(4) Trigger externally by the (–) slope and adjust the resonant frequency A (C151), then by (+) slope, adjust the resonant frequency B (C151) to keep the peak of the waveforms at 5.2 MHz $^{+0.2\ MHz}_{-0.1\ MHz}$.



No.	Item	ADJ location	Checking point	Measuring instrument	Reading
3	Playback Freq. response A-HEAD B-HEAD	R152 R156 R155 R151	TP101 (TRIG:TP103)	Oscilloscope	Flat between 2 MHz and 5.2 MHz (±1 dB) using alignment test tape.

(1) Play back the RF sweep signal of the βII alignment test tape.
(2) Adjust the tracking knob to maintain the maximum output levels of Ach and Bch.
(3) Continue to use the same connection of the oscilloscope as ITEM 1.
(4) Adjust Q-damp-A (R152) and playback frequency response A (R156) with (–) slope of the external trigger.
(5) Also adjust Q-damp-B (R151) and playback frequency response B (R155) with (+) slope of the external trigger.
(6) Adjust the playback frequency response controls A (R156) and B (R155), Q damping controls A (R152) and B (R151) until the response at the resonant point is maximum level and the waveform between the 2 MHz and the 5.2 MHz markers is as flat as possible for the both channels.





No.	Item	ADJ location	Checking point	Measuring instrument	Reading
4	Resonance freq. B_1' HEAD B_2' HEAD	C154 C153	TP101 (TRIG:TP103)	Oscilloscope	5.2 MHz $^{+0.2\ MHz}_{-0.1\ MHz}$ resonant frequency on both channels

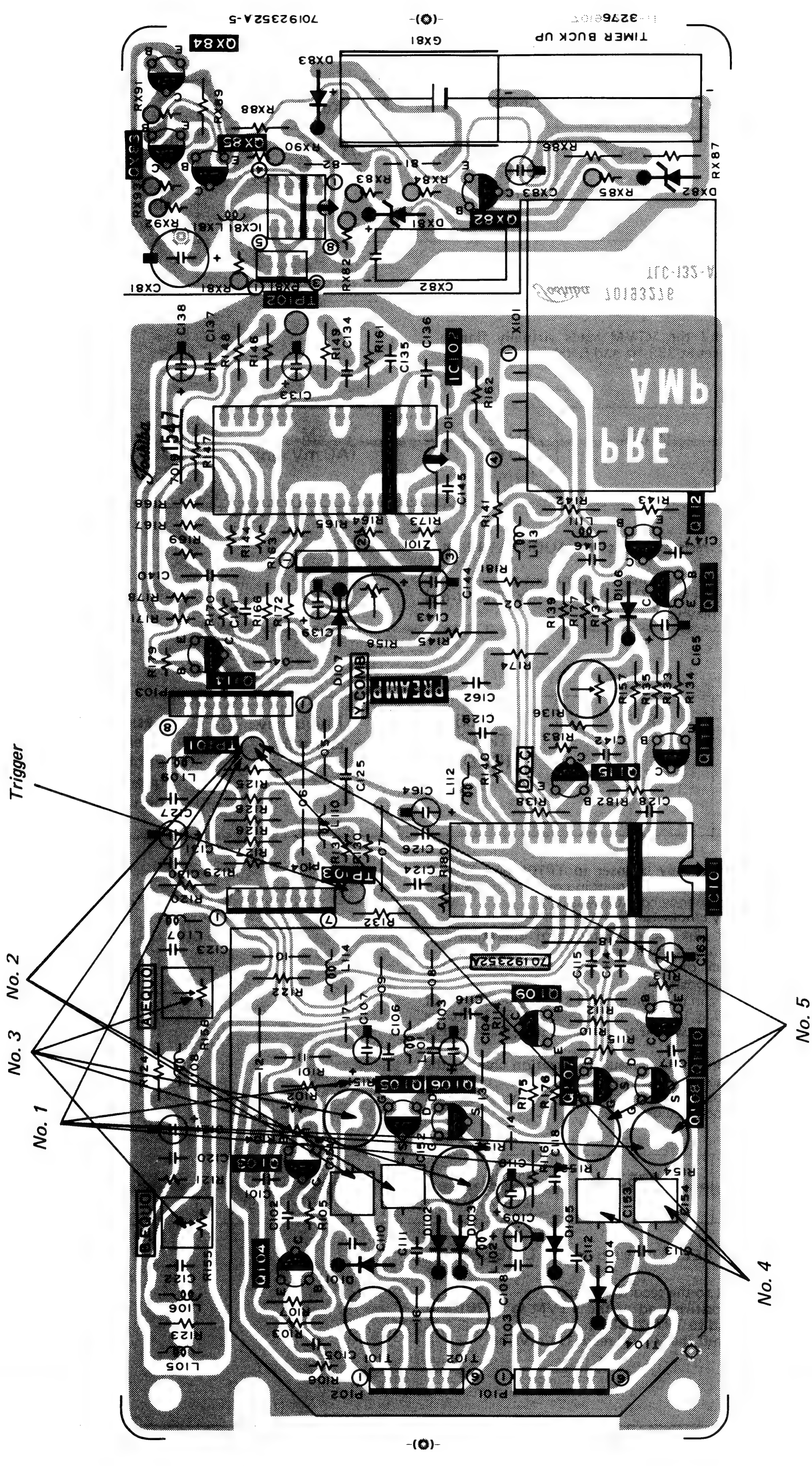
(1) Confirm if the No. 2 adjustment is correctly done and connect TPY04 to GND with jumper wire.
(2) Playback the RF sweep section of alignment tape.
(3) Connect the probe of the oscilloscope to TP101 and the trigger input to TP103.
(4) Adjust resonant frequency B_1' (C154) to keep the peak of waveform at 5.2 MHz $^{+0.2\ MHz}_{-0.1\ MHz}$ with (–) external trigger observing the output waveform of B_1' head by turning the TRACKING CONTROL knob clockwise from viewed front side.
(5) Adjust resonant frequency B_2' (C153) to keep the peak of waveform at 5.2 MHz $^{0.2\ MHz}_{-0.1\ MHz}$ with (+) external trigger observing the output waveform of B_2' head by turning the TRACKING CONTROL knob counterclockwise.

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
5	Playback freq. response B_1' head B_2' head	R154 R153	TP101 (TRIG: TP103)	Oscilloscope	Flat level between 2 MHz and 5.2 MHz (±1 dB)

(1) Playback the RF sweep section of alignment tape.
(2) Continue to use the same connection of the oscilloscope as item 4.
(3) Adjust Q damping B_1' (R154) so that the waveform between the 2 MHz and 5.2 MHz markers is as flat as possible with (–) external trigger observing the output waveform of B_1' head by turning TRACKING CONTROL knob clockwise.
(4) Adjust Q damping B_2' (R153) so that the waveform between the 2 MHz and 5.2 MHz markers is as flat as possible with (+) external trigger observing the output waveform of B_2' head by turning TRACKING CONTROL knob counterclockwise.
(5) Confirm if the output levels of both heads B_1' and B_2' are more than 0.3 Vp-p.

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
6	DOC level	R157	TV screen	Visual checking	Lesser dropouts

(1) Play back any pre-recorded tape known to have many dropouts.
(2) Turn R157 (Dropout compensator threshold level) fully counterclockwise as viewed from Parts side. The dropouts will appear on the monitor TV screen.
screen.
(3) Slowly turn R157 clockwise until the dropouts disappear, while observing it on the TV screen.


Trigger
No. 1
No. 2
No. 3
No. 4
No. 5
TIMER BUCK UP
PRE AMP
PREAMP
Y. COMB

4-7 AUDIO CIRCUIT ADJUSTMENT METHOD

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
1	Playback frequency Characteristics (1)	R751	AUDIO LINE OUT terminal	VTVM (AC mV range)	Within −1.0 ± 0.5 dB Same frequency response at 333 Hz and 5 kHz when alignment tape is played back.
	(1) Set R752 to the mechanical center as adjustment is impossible if it is at the leftmost position. (2) Play back the 333 Hz and 5 kHz sections of the alignment tape. (3) Adjust R751 until the VTVM reads virtually flat in frequency responses at 333 Hz and 5 kHz.				
2	Playback signal output level	R752	AUDIO LINE OUT terminal	VTVM (AC mV range)	−3 dBs (0.55 Vrms)±0.5dB of playback output level at 333 Hz.
	(1) Place a 47 kΩ resistor across the AUDIO LINE OUT terminal. (2) Play back the 333 Hz section of alignment tape. (3) Adjust R752 until the VTVM reads −3 dBs (0.55 Vrms) ±0.5 dB of the playback out level.				
3	Recording erase oscillation frequency	R754	TP705 TP706 (GND)	Frequency counter	Less than 1.8 kHz of difference between audio dubbing oscillation frequency and recording oscillation frequency.
	(1) Connect the frequency counter to TP705 and TP706. (2) Set the VTR in the audio dubbing mode of operation and note the frequency counter read. (3) Turn R754 fully clockwise. (4) Set the VTR in the recording mode of operation and note the frequency counter read. (5) If the difference of the two frequencies is within 1.8 kHz, leave R754 position. If the frequency in recording is 1.8 kHz higher than that in audio dubbing in Step (2) above, set R754 to its fully counter clockwise if lower, then turn R754 center position. (6) Check to insure that as a result of position change, the frequency difference is less than 1.8 kHz. NOTE:− R754 should be positioned in fully clockwise, counterclockwise or center.				
4	Bias current	R753	TP701 TP702 (GND)	VTVM (AC mV range)	1.9 mVrms
	(1) Set the INPUT SELECT switch to the LINE position. (No input) (2) Set up the VTR to the recording mode. (3) Connect the positive lead of the VTVM to TP701 and the negative lead to TP702 (GND). (4) Adjust R753 until the VTVM reads 1.9 mVrms.				

No.	Item	ADJ lcoation	Checking point	Measuring instrument	Reading
5	REC current level	R757	TP701 TP702 (GND)	Oscillator VTVM	–72 dBs between TP701 and TP702 during recording
	(1) Short between TP706 and TP707. (2) Connect VTVM to TP701 and TP702. (3) Input a reference signal of –10 dBs, 400 Hz from Audio oscillator to AUDIO LINE IN TERMINAL and set the VTR into Recording mode with LINE INPUT state. (4) Adjust R757 so that VTVM reads –72 dBs.				
6	Record-playback output level	Confirmation	AUDIO LINE OUT terminal	VTVM (AC mV range) AUDIO oscillator	Reference signal (–10 dBs, 400 Hz) playback output level is within –5 dBs ± 1 dB.
	(1) Set the INPUT SELECT switch to the LINE position. (2) Place a 47 kΩ resistor across the AUDIO LINE OUT terminal. (3) Input a reference signal of –10 dBs, 400 Hz from Audio oscillator to AUDIO LINE IN terminal. (4) Record and play back the input signals. (5) Check to insure that the VTVM reads the playback output level within –5 dBs ± 1 dB. (6) If the playback output level is out of –5 dBs ± 1 dB, the REC current level given in No. 5 adjustment above can be suspected, therefore, readjust R757 so that VTVM reading is within standard.				
7	Record-playback frequency Characteristics (2)	Confirmation	AUDIO LINE OUT terminal	VTVM (AC mV range) Audio oscillator	8 kHz playback output level is within 0 ± 1 dB as referenced to 400 Hz one.
	(1) Set the INPUT SELECT switch to the LINE position. (2) Connect input signals of 400 Hz and 8 kHz, –25 dBs (15 mVrms), one by one from the Audio oscillator to the AUDIO LINE IN terminal. (3) Record and play back the input signals. (4) Place a 47 kΩ resistor across the AUDIO LINE OUT terminal. (5) Check to insure that the VTVM reads the 8 kHz playback output level within 0±1 dB as referenced to the 400 Hz one. (6) If out of standard, the bias current given in No. 4 adjustment can be suspected. If it is over 1 dB, then adjust R753 so that the bias current may be higher than 1.9 mVrms. If below –1 dB, adjust for lower than 1.9 mVrms.				
8	BNR 1 kHz level	R755	AUDIO LINE OUT terminal	VTVM Audio oscillator	–5 dBs of playback output level at 1 kHz (–40 dBs) reference signal
	(1) Place a 47 kΩ resistor across the AUDIO LINE OUT terminal and playback the prerecorded tape with BNR switch ON. (2) Short between TP712 and TP706. (3) Input a reference signal of 1 kHz, –40 dBs between TP708 and TP709 and adjust R755 so that VTVM reads –5 dBs.				

CAUTION 1: If the normal audio frequency characteristics and playback output level (1) cannot be obtained as specified above, align the audio head and control head assembly in relation to the tape, and proceed with No. 1 through 7 adjustments again.

2: In recording the audio signal, and the video signal should be input together. If no video signal is recorded, this results in muting at the time of unstable to the tape speed in playback.

3. The adjustments of No. 1 through No. 7 should be done with BNR switch off.

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
9	BNR Limiter	R756	AUDIO LINE OUT terminal	VTVM Audio oscillator	–5.6 dBs of playback output level at 10 kHz (–40 dBs) reference signal

(1) Proceed with steps (1) and (2) in No. 8 adjustment above.
(2) Input a reference signal of 10 kHz, –40 dBs between TP708 and TP709 (GND) and adjust R756 so that VTVM reads –5.6 dBs.

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
10	BNR Encode frequency characteristics	Confirmation	Pin 18 of IC702	VTVM Audio oscillator	In recording mode with BNR switch ON, the levels of pin 18 are as shown in table below.

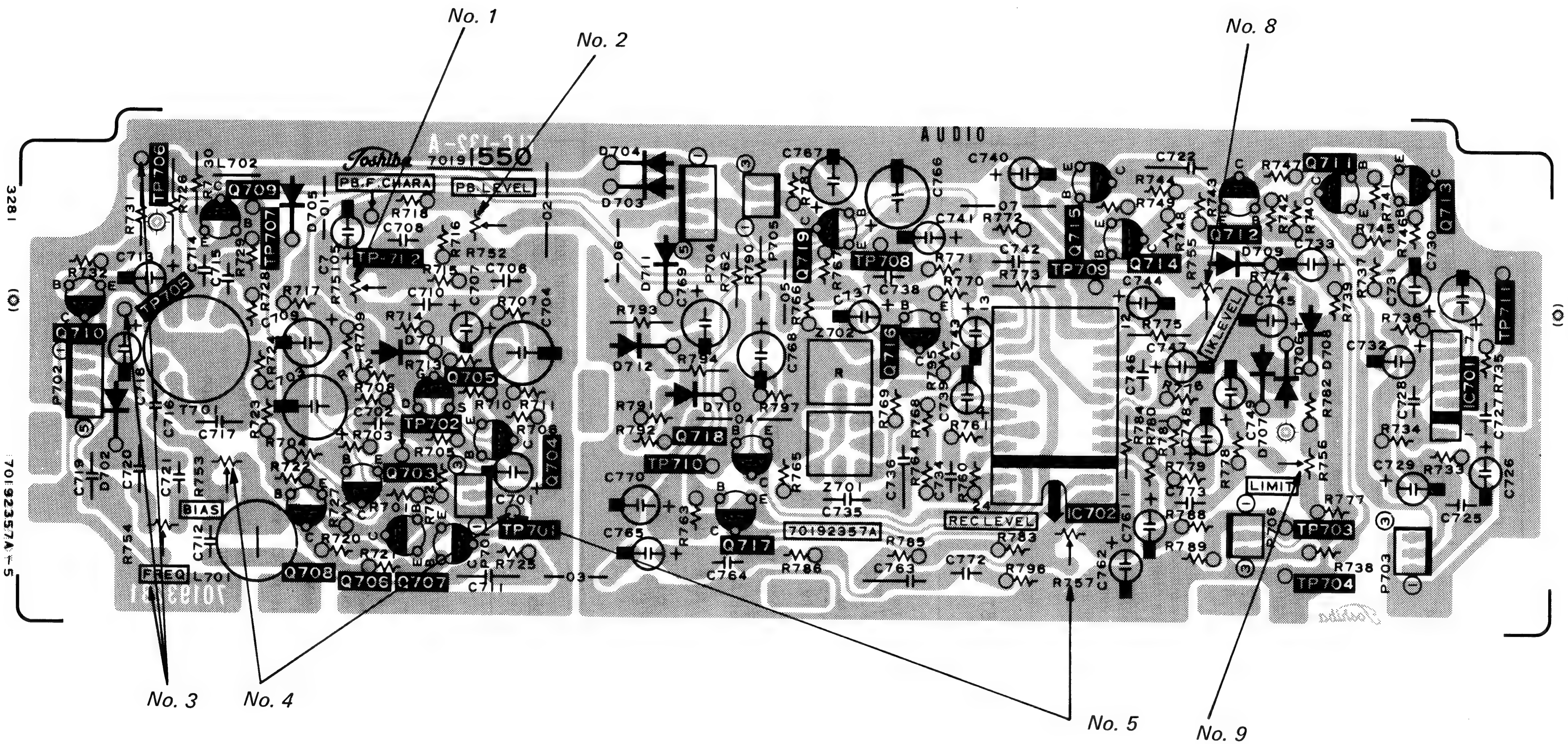
(1) Set the VTR into LINE recording mode with BNR switch ON.
(2) Input reference signals of 70 Hz (–50 dBs), 1 kHz (–50 dBs) and 10 kHz (–50 dBs) to AUDIO LINE IN terminal.
(3) Confirm the reading of VTVM as shown table below.

Audio LINE input	Level of Pin 18 on IC702
70 Hz (–50 dBs)	45.8 dB ± 2 dB
1 kHz (–50 dBs)	42.3 dB ± 2 dB
10 kHz (–50 dBs)	39.3 dB ± 2 dB

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
11	BNR DECODE frequency characteristics	Confirmation	TP703 TP704 (GND)	Audio oscillator VTVM	In playback mode with BNR switch ON, the levels between TP703 and TP704 are as shown in table below.

(1) Place a 47 kΩ resistor across the AUDIO LINE OUT terminal and play back the prerecorded tape with BNR switch ON.
(2) Short between TP712 and TP706 and connect VTVM to TP703 and TP704.
(3) Input reference signals of 70 Hz (–70 dBs), 1 kHz (–70 dBs) and 10 kHz (–70 dBs) between TP708 and TP709 (GND).
(4) Confirm the reading of VTVM as shown table below.

TP708 input signal	Level between TP703 and TP704
70 Hz (–70 dBs)	45.5 dB ± 2 dB
1 kHz (–70 dBs)	49.9 dB ± 2 dB
10 kHz (–70 dBs)	61.4 dB ± 2 dB


No. 1
No. 2
No. 3
No. 4
No. 5
No. 8
No. 9
AUDIO
PB.F.CHARA
PB.LEVEL
BIAS
FREQ
REC LEVEL
LIMIT
70192357A

4-8 TUNER ADJUSTMENT METHOD

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
1.	Tank resonant	L004	TP12 TP14	Signal generator Oscilloscope DC power supply	Described below

(1) Unsolder the IF OUTPUT lead wire on the Tuner to disconnect from the base of Q001. Then, connect the output lead of the signal generator to the base of Q001.
(2) Set the signal generator output signal to 38.9 MHz and 25 mVrms with 75Ω termination.
(3) Connect the oscilloscope to TP12.
(4) Set the oscilloscope input AC-DC switch to the DC position.
(5) Connect the DC power supply to TP14.
(6) Adjust the DC power supply output voltage to 3.5 V (IF AGC voltage) at TP12 while observing the oscilloscope.
(7) Now, adjust the core of L004 until the DC voltage at TP12 is minimized on the oscilloscope screen.

NOTE: In Step (9), if the DC voltage at TP12 decreases to the noise inverter level around 3.5 V, then repeat Steps (6) and (7).

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
2.	AFT Balance	R051	Pins 5 and 6 on IC002	DC power supply Oscilloscope	DC voltage across pins 5 and 6 is 0 V ± 0.2 V

NOTE: No input signal should be fed in adjustment.
(1) Unsolder the IF OUTPUT lead wire on the Tuner to disconnect from the base of Q001. Then, connect the output lead of the signal generator to the base of Q001.
(2) Connect the other DC power supply to TP14.
(3) Adjust the DC power supply output voltage to 0V (IF AGC voltage).
(4) Connect the oscilloscope probe to pin 5 on IC002 and the grounding lead to pin 6.
(5) Set the oscilloscope input AC-DC switch to the DC position.
(6) Adjust R051 (AFT BALANCE) until the oscilloscope shows 0 V ± 0.2 V.

CAUTION: Before carrying out this adjustment, make certain that the channel keyboard is connected in position.

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
3.	AFT frequency	L005	Pins 5 and 6 on IC002	Signal generator Oscilloscope DC power supply	DC voltage across pins 5 and 6 is 0 V± 0.2 V

NOTE: Do not connect another DC power supply to TP14 for internal AGC.
(1) Unsolder the IF OUTPUT lead wire on the Tuner to disconnect from the base of Q001. Then, connect the output lead of the signal generator to the base of Q001.
(2) Set the signal generator output signal to 38.9 MHz, 25 mVrms.
(3) Connect the oscilloscope probe to pin 5 on IC002 and the grounding lead to pin 6.
(4) Set the oscilloscope input AC-DC switch to the DC position.
(5) Turn the core of L005 all the way to the right, or into the bottom, looking toward the printed pattern side.
(6) Now, turn L005 counterclockwise until the oscilloscope shows 0 V ± 0.2 V.

No.	Item	ADJ location	Checking point	Measuring instrument	Reading
4	RF AGC	R052	TP15	Signal generator Oscilloscope DC power supply	DC voltage at TP15 is 6.5 V ± 0.2 V
	NOTE: Do not connect another DC power supply to TP14 for internal AGC. (1) Unsolder the IF OUTPUT lead wire on the Tuner to disconnect from the base of Q001. Then, connect the output lead of the signal generator to the base of Q001. (2) Set the signal generator output signal to 38.9 MHz, 25 mVrms with 75Ω termination. (3) Connect the oscilloscope to TP15. (4) Set the oscilloscope input AC-DC siwtch to the DC position. (5) Now, adjust R052 (RF AGC) until the oscilloscope shows 6.5 V ± 0.2 V.				
5	Discriminator	L009	Pin 5 of P002	Signal generator VTVM	Maximum amplitude
	(1) Connect the signal generator to the cross point between Z002 and C020. (2) Set the 5.5 MHz FM-AM signal generator output signal to 1 KHz with 30%, 15 kHz FM modulation. (3) Connect the VTVM to pin 5 of P002. (4) Adjust L009 so that VTVM reading is max amplitude.				

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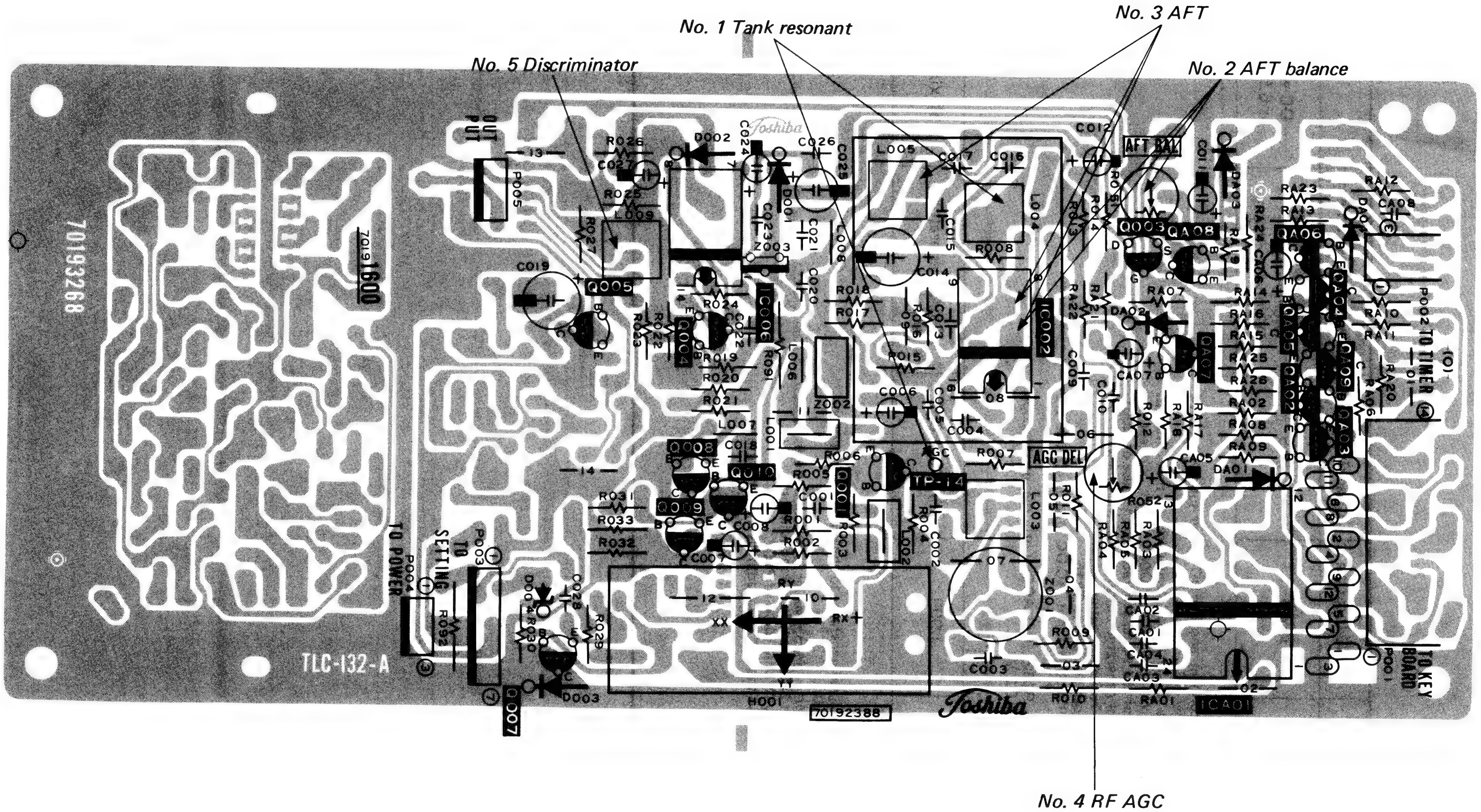


SECTION 5 MECHANICAL DESCRIPTION

5-1. GENERAL

1. Difference of V8600B from Previous Mode V-5470B.

1. The function of operational pushbuttons is controlled by electronic Logic circuit.
2. The cylinder assembly is fixed cylinder, with the usual intermediate drum eliminated.
3. The reel tables are driven through gears.
4. An additional speed change arrangement provides selection of two picture search speeds: approximately 7 times and 25 times playback speed.
5. An additional damper feature provides gentle initial motion of the cassette compartment when this is lifted up in ejecting the cassette.

2. Feature of Mechanical Arrangements

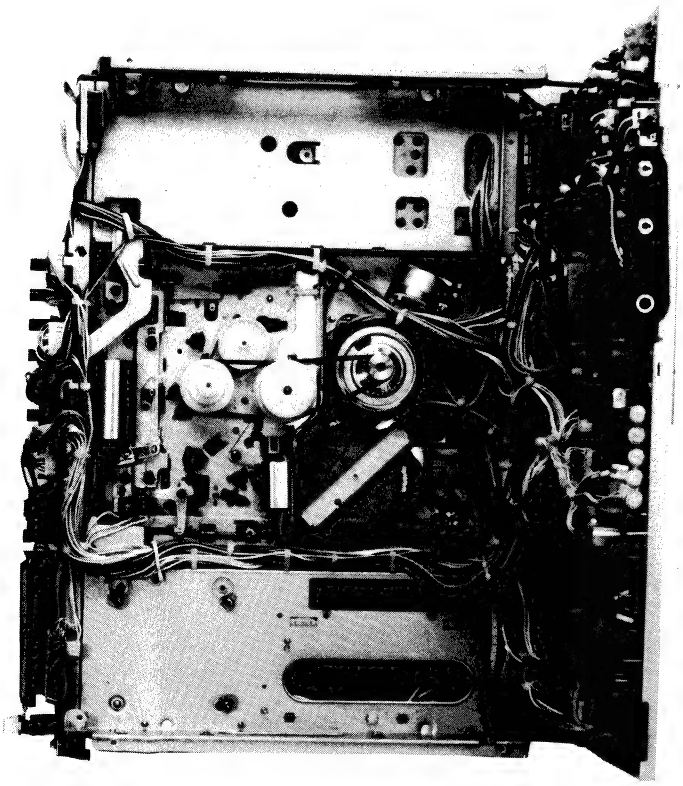
The Drive System in the V-8600B uses three motors: a video head motor, a capstan motor, and loading motor thereby providing compact construction and high performance characteristics. The video head motor, which is built-in the cylinder assembly, directly drives the video heads disk and at the same time, drives the reel tables through belts and gears.

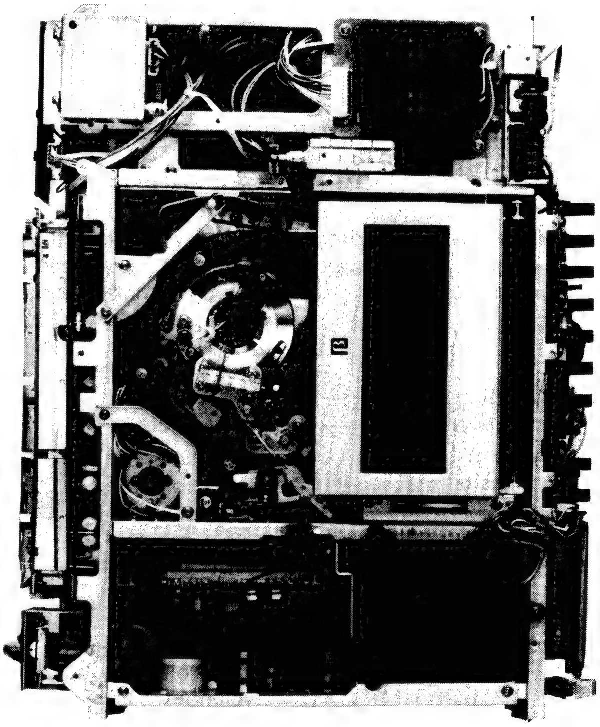
The gears used for driving the reel tables provides higher operational reliability than usual. The capstan motor drives the capstan solely to assure a stable tape running, thereby providing highly improved recording and playback performance characteristics.

The electronic logic circuit for the operating push button controls activates the respective solenoids for setting in an appropriate mode of operation, thus providing highly improved operationability. The cassette compartment lifting mechanism has a new damper feature which provides gentle initial motion in ejecting the cassette, thus protecting this against injury.

A new picture search speed selecting arrangement is capable of switching picture search speed either to 7 or 25 times the normal playback speed.

The new cylinder assembly is the fixed cylinder with intermediate drum eliminated, thereby protecting the damage against the thin long time recording tape.





3. Mechanical Drive Arrangement

1. The loading disk is driven by provided DC motor (loading motor) through the loading drive assembly.
2. The capstan is driven by a provided DC motor (capstan motor) through the motor pulley and flat belt.
3. The video heads and reels are driven by a DC motor (cylinder motor). More details are as follows:
   1) The video heads are directly driven.
   2) The reels are driven in a serial transmission from the motor pulley, planetary gear unit assembly and two square belts, to the FF clutch assembly. The succeeding drive transmission from the FF clutch assembly is different depending on the mode of operation.
      a. In recording or playback mode
         From the FF clutch assembly through the play pulley and play idler to the take up reel table assembly.
      b. In rewinding mode
         From the FF clutch assembly through the FF gear and REW gear to the supply reel table assembly.
      c. In fast-forward mode
         From the FF clutch assembly through the FF gear to the take up reel table.
      d. In review mode
         From the motor pulley through the planetary gear unit assembly for speed reduction, FF clutch assembly, and REW gear to the supply reel table.
      e. In cue mode
         From the motor pulley through the planetary gear unit assembly for speed reduction, FF clutch assembly, and FF gear to the take up reel table assembly.
4. For setting each mode of operation, the extracting or attracting forces of the respective solenoids are used as listed below.

MODE OF OPERATION	SOLENOIDS
a. Recording, audio dubbing, and playback (including two times normal speed.)	Play solenoid and pinch lock solenoid, (Pause solenoid is energized until pinch lock solenoid is energized for attraction in recording or audio dubbing modes.
b. Rewinding	REW solenoid.
c. Fast-forward	FF solenoid.
d. Review (7 times normal speed)	REW solenoid and CUE/REV solenoid.
e. Cue (7 times normal speed)	FF solenoid and CUE/REV solenoid.
f. Super scan (review)	REW solenoid.
g. Super scan (cue) Cue 25 times normal playback speed)	FF solenoid.
h. Pause	Play solenoid and pause solenoid.
i. Still	Play solenoid and pinch lock solenoid.

Note: When VCR is set into stop mode from any operation mode, the playback solenoid is energized to prevent the tape sticking.

5-2 MECHANICAL OPERATION

1. Cassette Compartment Lock Operation
1-a. Cassette Compartment Locking Operation
(see Figs. 5-1, 5-2)

Install the cassette in the cassette compartment ⑩. The cassette prompts the cassette lid unlock lever ⑬ to disengage the cassette lock tab, making it possible to open the cassette lid.

Press the cassette compartment ⑩ downward by hand. The cassette compartment roller at the end of the lift arm ⑭ kicks the locker ⑨ rightward (→) once. The locker ⑨, then, returns to the original position again. The concave of locker ⑨ holds the cassette compartment roller ⑪ to lock the cassette compartment assembly.

The cassette presses the cassette detect slider ⑫. downward. The detect lever ⑦ moves in the arrow direction (↖). The detect lever ⑦, in turn, detaches the roller ⑤ of the detect plate assembly ④ from the cam way. The loading disk ⑥ is allowed to turn.

At the same time, the detect sublever ⑮ kicks the cassette detect switch ⑯, which allows tape loading.

NOTE: The cassette lid is opened by the top of the cassette lid opener ⑰.

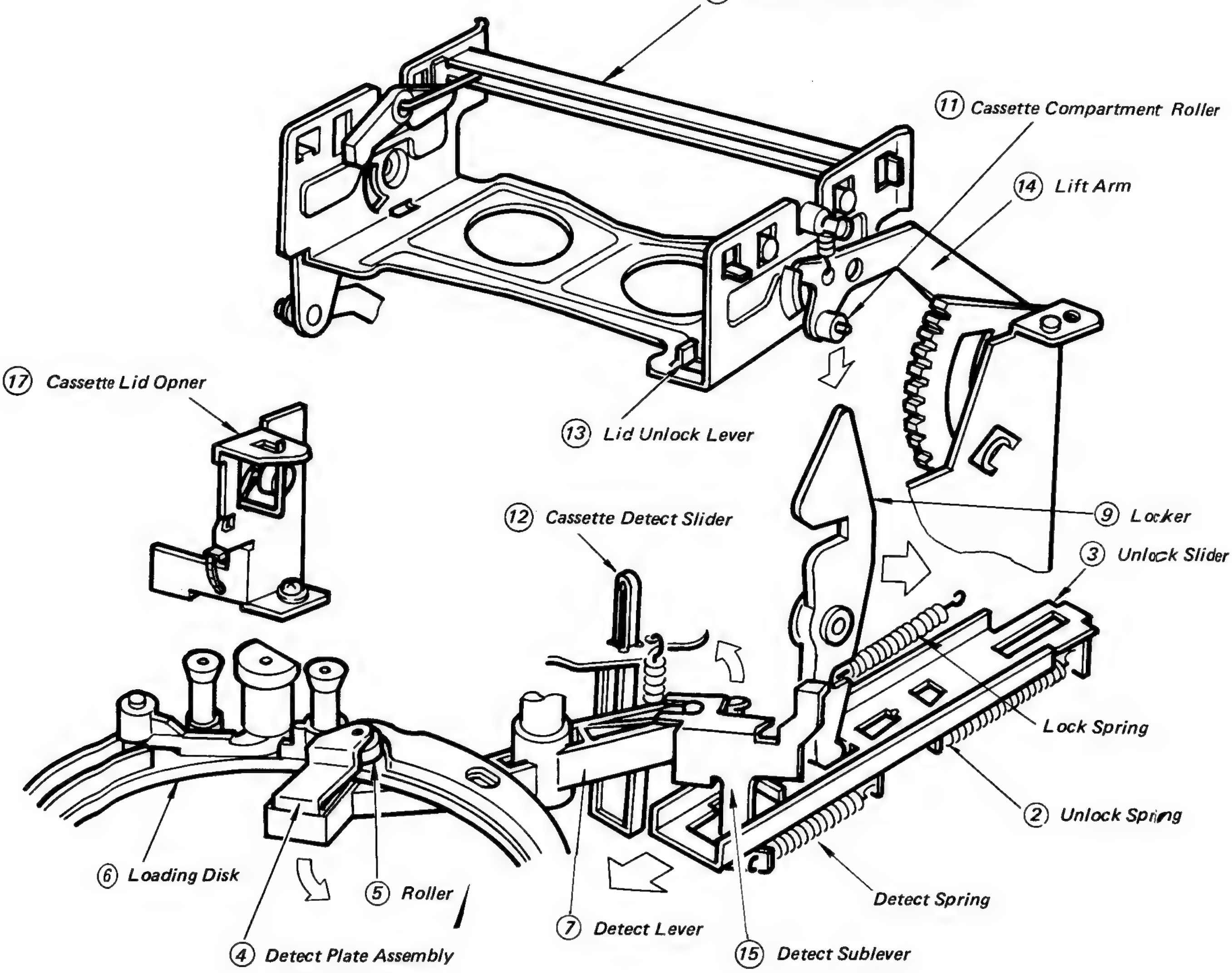


Fig. 5-1 Cassette Compartment Lock Operation

1-b. Cassette Compartment Lifting Operation (see Figs. 5-1, 5-2)

When the loading disk ⑥ reaches the unloading end position, the roller ⑤ of the detect plate assembly ④ comes into the cam way. The detect lever ⑦ , then, turns clockwise.

The unlock slider ③ slides in the arrow direction (↑) to turn the locker ⑨ , which releases the cassette compartment roller ⑪ . This allows the lifter spring to start raising the cassette compartment ⑩ .

With the cassette compartment ⑩ raised up, the locker ⑨ is kicked further to press the unlock slider ③ out in the arrow direction (←). The unlock slider ③ further turns the detect lever ⑦ .

The cassette detect slider ⑫ returns upward. This completes lifting operation of the cassette compartment ⑩ .

NOTE: During unloading, the cassette compartment cannot be lifted up. The reason is as follows: The eject solenoid moves the unlock lever ① in the arrow direction (↗). The unlock spring ② forces the unlock slider ③ in the arrow direction (↑). As the roller ⑤ of the detect plate assembly ④ is in contact with the inside of the cam of the loading disk ⑥ , however, the post ⑧ of the detect lever ⑦ functions as a stopper to prevent the locker ⑨ from moving. Consequently, the cassette compartment ⑩ cannot be lifted.

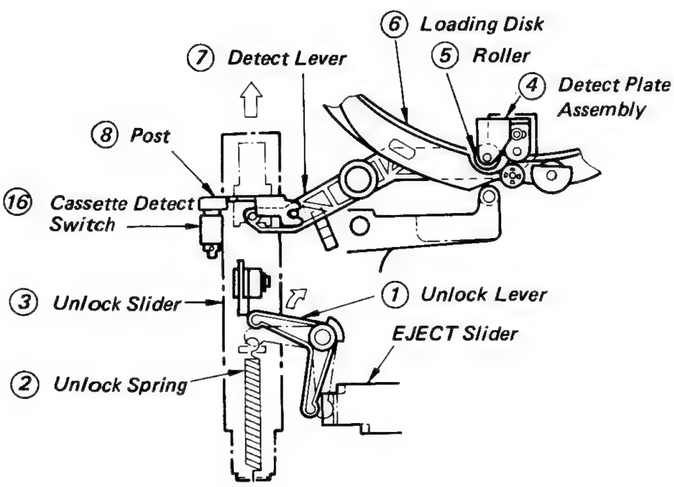


Fig. 5-2 Cassette Compartment Lifting Operation

2. Tape Loading and Unloading Operations

2-a. Tape loading operation

When a cassette is inserted into the cassette compartment assembly, the roller of the detect plate assembly detaches from the cam way on the loading disk, as described in Subsection 1. This causes the cassette detect switch to turn on, which feeds a voltage to the loading motor.

Then the loading motor rotates, and drives the loading disk to start turning counterclockwise through the gears of the loading drive assembly. With the loading disk starting turn, the roller of cam follower plate rides onto the cam face. This moves the cam follower lever, which in turn moves the loading slide bar coupled therewith. The loading slide bar, then, detaches the brake levers from the supply and take up reel tables. This allows the tape to be loaded from the supply and take-up reels.

With the loading disk turning further, the tape is brought out of the cassette gradually with the aid of the leading guide pole and the second, third, and fourth guide poles, each of which has a roller put on.

Also, right after the loading disk turning has been started, the roller of the T-type cam follower plate is moved as guided by the cam face of the loading disk. The roller, in turn, moves the tension lever to a specified point.

The tape led out by the guide poles and tension lever is wound on the tape transport system in the order of the entrance guide and full width erase head, cylinder, audio and controls heads, and exit guide, while the loading disk is turned.

In the course of loading the tape, the pinch roller guide plate kicks the pinch roller lever so that the top edge of the tape may fitted along the cylinder lead.

When the tab on the bottom of the loading disk comes in contact with the stopper of the cylinder base, the loading end detecting lever moves. The lever activates the loading end detecting switch to turn on, which issues the stop signal. The stop signal is fed to the loading motor to stop. This completes tape loading.

At the loading end position, the roller of the cam follower plate detaches from the cam way. This actuates the supply and take up brakes to brake the reel tables. After the reel tables have been fully stopped, the play solenoid is activated for a moment to actuate the tension lever to slack the tape properly.

2-b. Tape unloading operation

When the EJECT button is pressed, first the eject solenoid is energized, which moves the eject solenoid lever. The lever, in turn, moves the eject slide bar, which moves the cam follower lever coupled therewith. The cam follower lever detaches from the cam way. At the same time, the cam follower lever moves the loading slide bar, which brings the supply and take up brakes away from the reel tables.

With the eject slide bar moving, the lock releasing lever is turned around to come into the same state as given in ITEM "Cassette Compartment Lifting Operation". At the same time, also, the unloading sublever is turned around to press the unloading idler lever to the take up reel table.

At the time of complete movement of the eject slide lever, or at the end of the solenoid action, the eject slide bar actuates the eject detect switch to turn on. The switch, then, issues and feeds a signal to the loading motor to rotate. With the loading motor rotating, this drives through the gears of the loading drive assembly the loading disk to start clockwise turn. At the same time when the loading disk turns, the cluch pulley and belt of the loading drive assembly turn the unloading idler which has been pressed to the take up reel table. The unloading idler turns the take up reel table. This allows the tape to be wound into the cassette according as the loading disk is turned about.

When the roller of the detect plate assembly is brought into the cam groove of the loading disk with this turned about, the cassette compartment is lifted upward. This actuates the cassette detect switch to be turned off, which stops the loading motor.

The attraction by the eject solenoid is released in approximately 0.5 sec. after the cassette detect switch was turned off. This is followed by unlocking of the cam follower lever and unloading sublever. In turn, the both supply and take up reel tables are braked and the unloading idler is detached from the take up reel table. This completes tape unloading operation.

3. Auto Stop Operation

In any of the following events, the VCR in any mode of operation is released to the stop state to protect the tape against damage:

1. In the playback recording or audio dubbing mode of operation, the slack lever detects excessive slack on the tape. The slack lever, then, turns on the slack lead switch, which releases the VCR into the stop state.
2. At the end of tape in the fast-forward, rewinding, playback, recording or audio dubbing mode of operation, the sensing coil picks up a signal from the tape leader or trailer. The signal releases the VCR into the stop state.
3. In the rewinding mode, the auto-stop mechanism stops rewinding when the Tape Counter reaches "9999" with the COUNTER MEMORY switch in the ON position. In the review and other modes, however, the counter memory operation does not function.
4. If dew develops on the surface of the cylinder, the dew sensor detects it and activates the auto-stop solenoid to hold the tape stopped. In any mode of operation, the VCR is in the loading operation, it is switched to the unloading operation, allowing the cassette to be taken out. Note that until the dew disappears, any operation is inhibited but the unloading operation is permitted only.

5. If the Quick Select Switch is ON during playbacking, the start of each recorded programme is identified so that during subsequent rewind or fast-forward operation the tape automatically stops at the beginning of each recording.

4. Operation without Cassette (see Figs. 5-3, 5-4)

To operate the VCR in a desired mode without a cassette, follows:

1. Remove the upper cover and cassette cover as directed in Section 3-3-1, the "How To Replace the Cabinet and Associated Components".
2. Turn the power switch on.
3. Press the cassette compartment reinforcing bracket ② of the cassette compartment assembly ① downward (↓) to lock.
4. Press the cassette detect slider ③ downward (↓) until it is locked by the detect lever ④, to operate the loading disk ⑤. This allows the VCR to operate in any mode except the recording, playback, and audio dubbing modes.
5. To operate in the playback mode, hold the slack lever ⑦ by hand or tape so that the tape slack detect switch ⑥ cannot function. For recording or audio dubbing mode, press the record safety slider ⑧ and hold the slack lever ⑦ the same as playback mode by hand together with the REC or AUDIO DUB button.

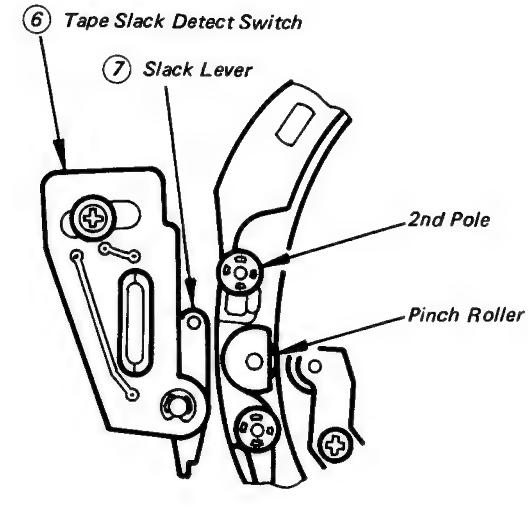


Fig. 3-4.

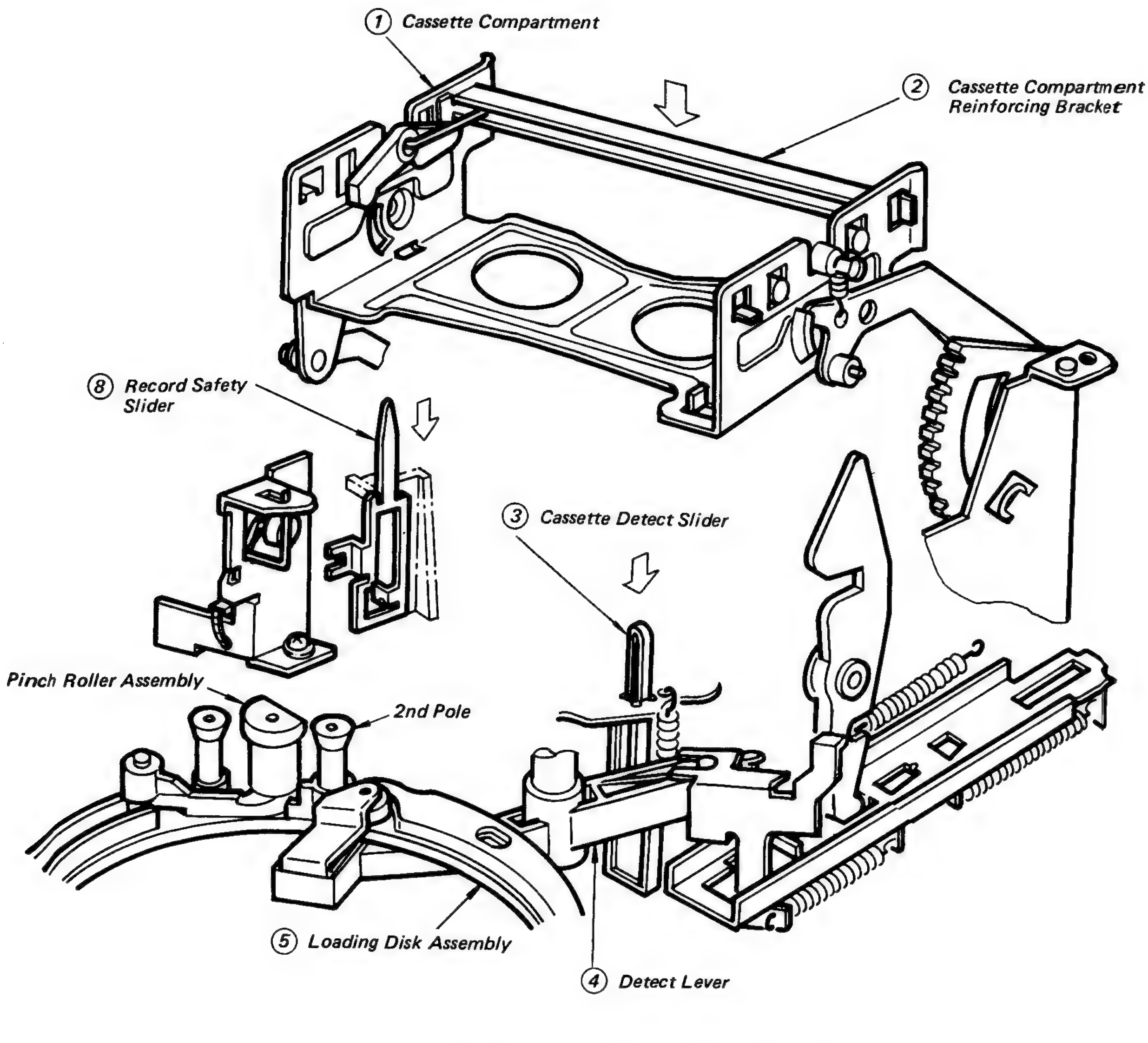


Fig. 5-3 Setting for Operation without Tape Cassette

5. Operating without Cassette Compartment Assembly (see Figs. 5-5, 5-6)

To place a cassette in any mode of operation with the cassette compartment removed, follows:

1. Turn power off.
2. Remove the upper cover and cassette cover as directed in Section 5-3-1, the "How To Replace the Cabinet and Associated Components".
3. Remove the "E" ring (E-3) ⑦ and the sublink ⑤ on each side of the cassette compartment ⑥. cassette compartment ⑥. (see Fig. 5-5)
4. Unhook the cassette retainer spring ⑧ from the cassette retainer ⑨ on each side of the cassette compartment ⑥.
5. Take out the cassette compartment ⑥ for removal.
6. In turn, holding the cassette ① by your left hand, disengage the cassette lock pawl ③ using a bladed screw driver ②. (see Fig. 5-6)
7. Open the cassette cover ④ in the arrow direction (↗).
8. Leaving the cassette cover ④ open, place the cassette in position on the reel tables and cassette reference post.
   CAUTION: Care should be observed not to damage the cassette lid opner, tension lever, and pinch roller.
9. Put a weight of 1 kg onto the top of the cassette.
10. Turn power on by pressing any of the functional buttons. Then, tape will be loaded and fitted to the tape transport guides and other arrangements.
11. Press a desired functional button.

To unload the cassette with the cassette compartment removed, follows:

1. Press the EJECT button. Tape unloading will start.
2. Right after tape unloading is completed, turn power off by releasing all of the functional buttons.
   CAUTION: If power is not turned off right after tape unloading is completed, the cassette-in switch is in the ON position. The result is that the tape is loaded again.
3. Remove the weight which has been put on the top of the cassette.
4. Take the cassette out.

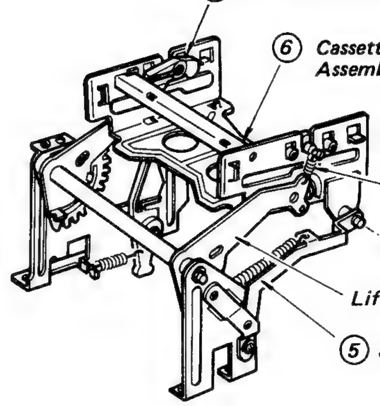


Fig. 5-5 Cassette Compartment Removal

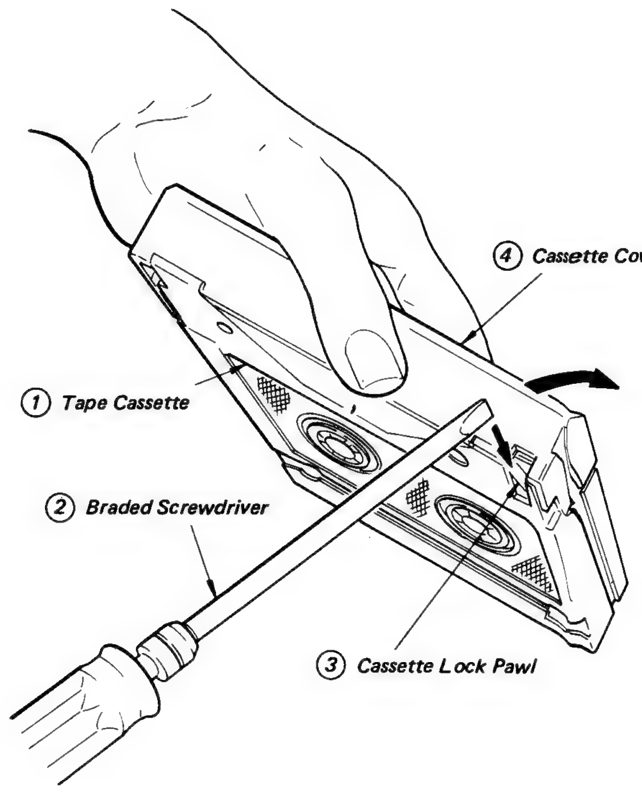


Fig. 5-6 Cassette Lid Opening

5-3. ADJUSTMENT AND REPLACEMENT

1. How to Replace the Cabinet and Associated Components

1-1. Replacing the Cabinets

Removal (Fig. 5-7)

1. Remove the four screws holding the bottom cover ①.
2. Take out the bottom cover ①.
3. Press the EJECT button for lifting the cassette compartment up with power on.
4. Remove the three screws holding the upper cover ②.
5. Take out the upper cover ②.
6. Remove the four screws holding the front panel ③.
7. Disconnect 14 pin connector (P001) from the selector board.
8. Take out the front pannel ③.
9. Remove the three screws holding the Keyboard.
10. Take out the Keyboard for removal.

Installation

To assemble the cabinet components, reverse Steps 1 through 10.

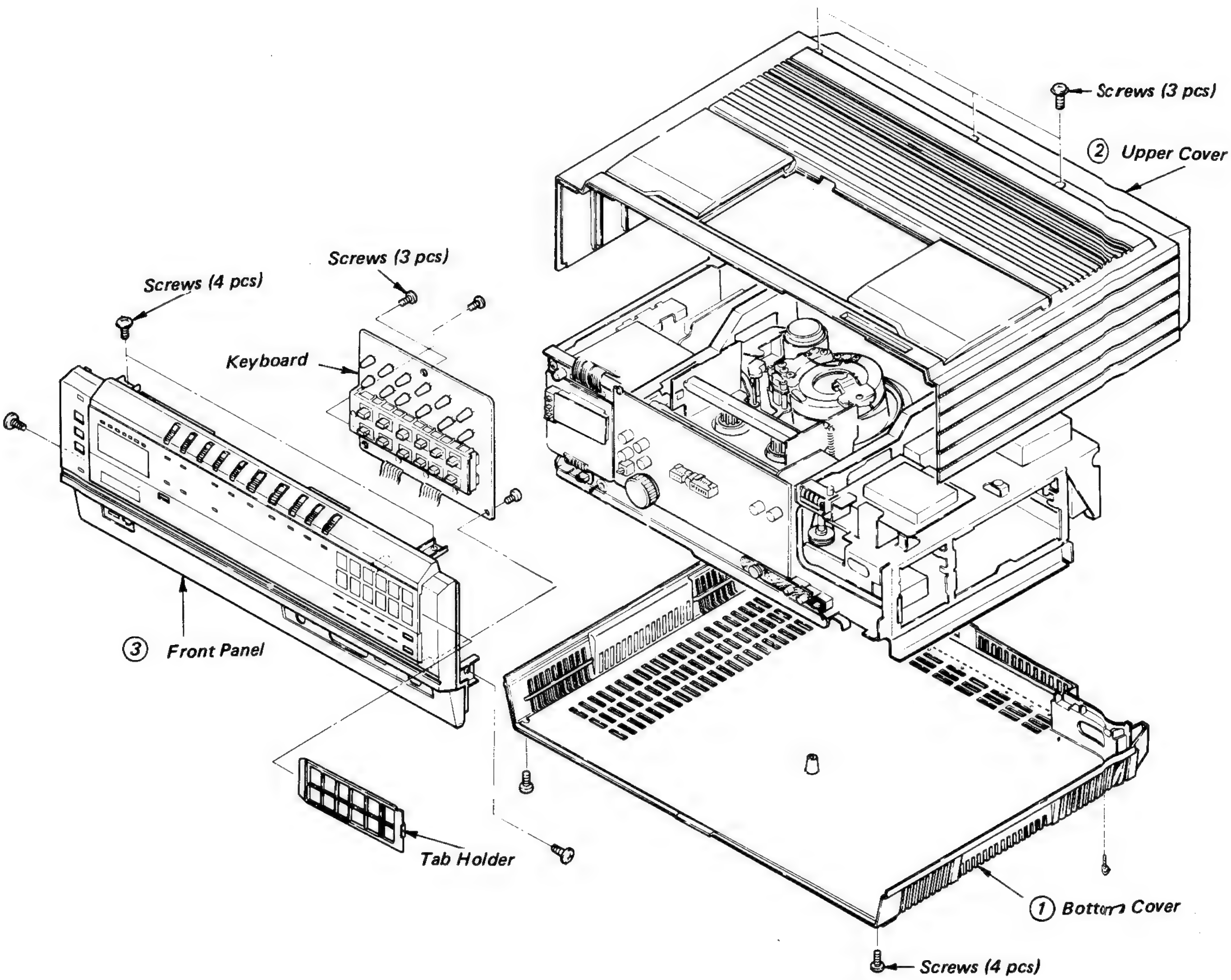


Fig. 5-7 Replacing the Cabinets

1-2. Replacing the Cassette Cover

Removal (see Fig. 5-8)

1. Remove the two screws ① on each side, holding the cassette cover ②.
2. Pull the cassette cover backward (toward the front panel) for removal.
(The cassette cover is secured by the right- and left-hand pawls of the cassette compartment.)

Installation

1. Press the cassette cover downward then push it backward (toward the rear panel).
2. Make certain that the cassette cover is securely fitted with the right- and left-hand pawls of the cassette compartment.
3. Tighten two screw hold the cassette cover on each side.

1-3. Replacing the Tuner Block

Removal (Fig. 5-9)

1. Unplug the 5-pin connector ③ from the antenna terminal board and the 8-pin connector ④ from the RF Modulator.
2. Further, unplug the 3-pin connector ⑤ (P002) and 3 pin connector ⑥ (P004) and 3-pin connector ② (P006) from the Selector Board.
3. Remove the five screws ② holding the Tuner Block ①.
4. Pull the Tuner Block ① sidewards.

Installation

Reverse Step 1 through 4 above.

CAUTION: The cabinet must be removed before replacing the Tuner Block.

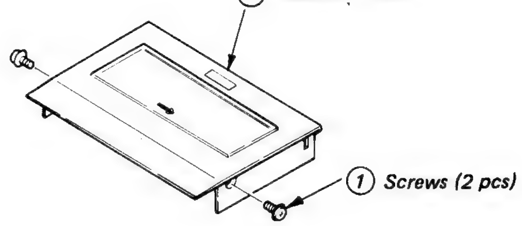


Fig. 5-8 Replacing the Cassette Cover

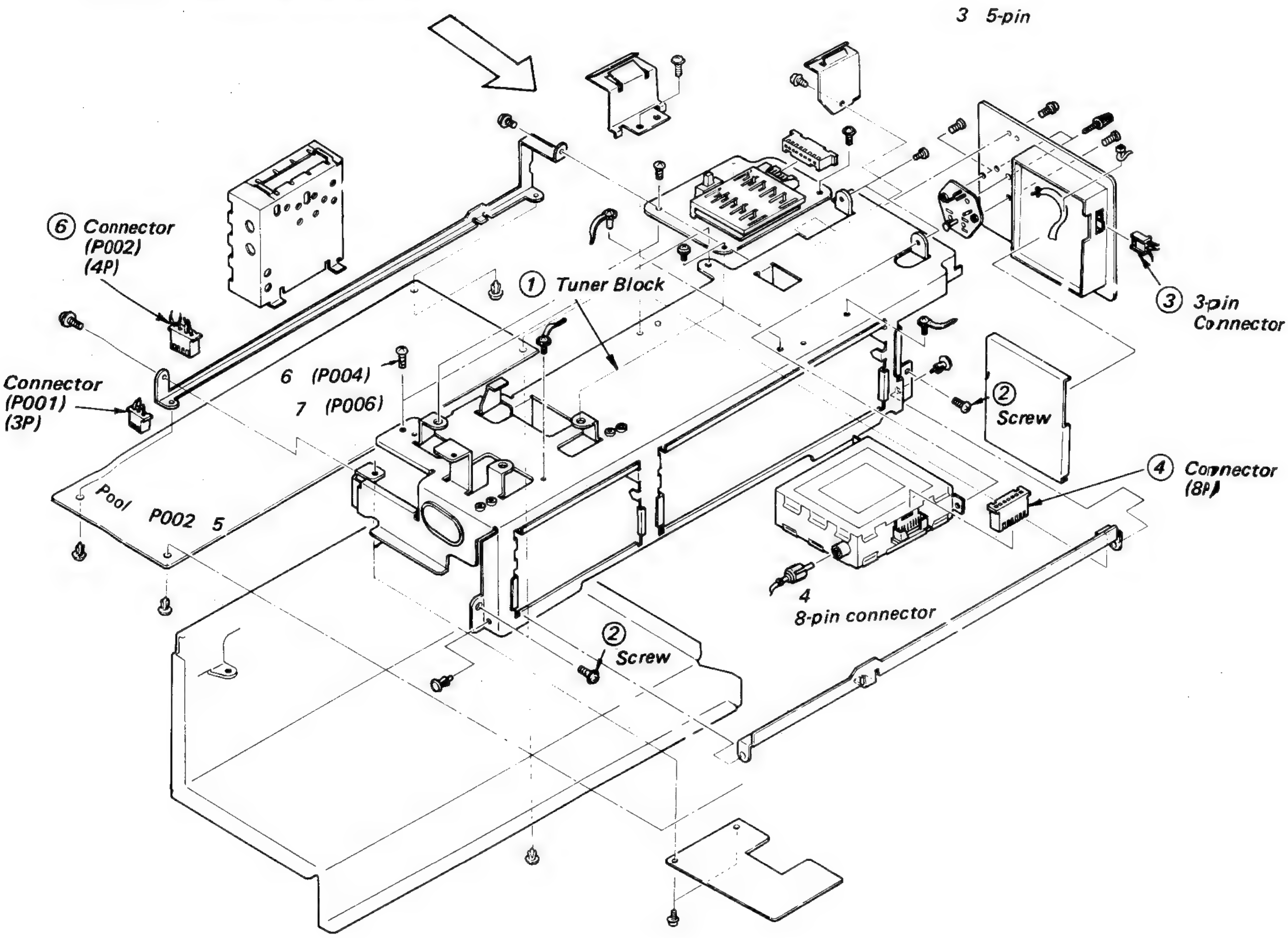


Fig. 5-9 Replacing the Tuner Block

1-4. Replacing the Tape Counter

Removal (Fig. 5-10)

1. Remove the counter belt ② from the counter pulley ③.
2. Remove the two screws ④ holding the counter mounting bracket.
3. Take out the counter mounting bracket ① from the right-hand frame.
4. Disconnect the lead wires ⑤ (Green and Pink) from the counter ⑥.
5. Remove the screw ⑦ holding the counter ⑥.
6. Take out the counter ⑥.

Installation

Reverse Steps 1 through 5 above.

CAUTION: In installation, care should be observed not to cross nor twist the counter belt.

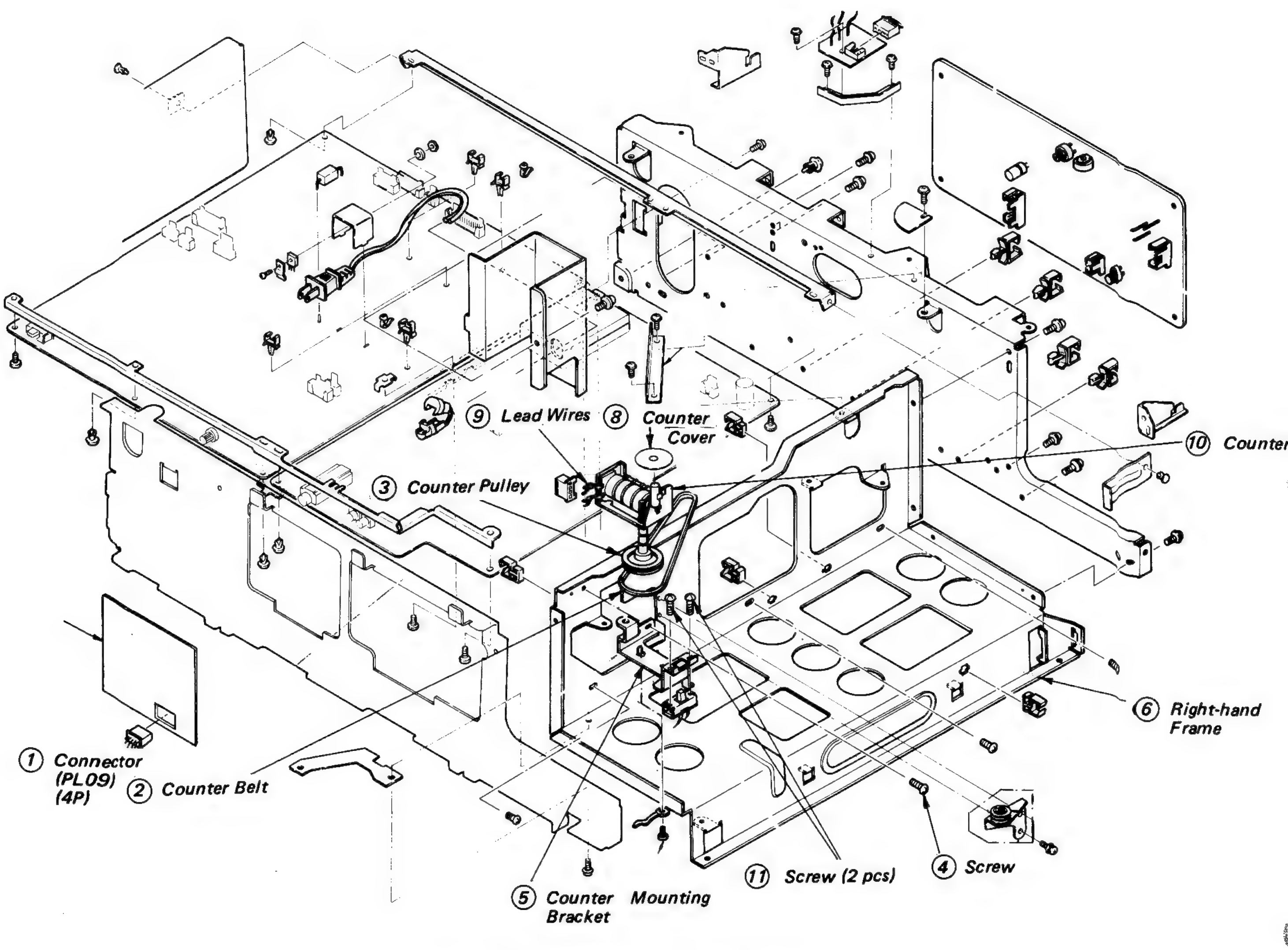


Fig. 5-10 Replacing the Tape Counter

2. Replacing the Cassette Compartment Assembly

Removal

1. Press the EJECT button to raise up the cassette compartment ① with power on.
2. Remove the upper cover and cassette cover as directed in Section 5-3-1, the "How To Replace the Cabinet and Associated Components".
3. There is provided a cassette retainer spring ④ between the lift arm ② and cassette retainer assembly ③ on each side of the cassette compartment ①. Unhook the cassette retainer spring ④ only from the cassette retainer assembly ③.
4. Remove the "E" ring ⑥ coupling the sublink ⑤ on each side of the cassette compartment ①.
5. Pull the sublink ⑤ out of the pin.
6. Incline the cassette compartment ① backward until the end of the lift arm ② appears out of the antidropping bracket on the side of the cassette compartment ①.
7. By making wide the right-hand and left-hand lift arms ②, take the shaft of the cassette compartment ① off the lift arms ②.

Installation

1. To reassemble the cassette compartment ①, reverse Steps 1 through 7 above.

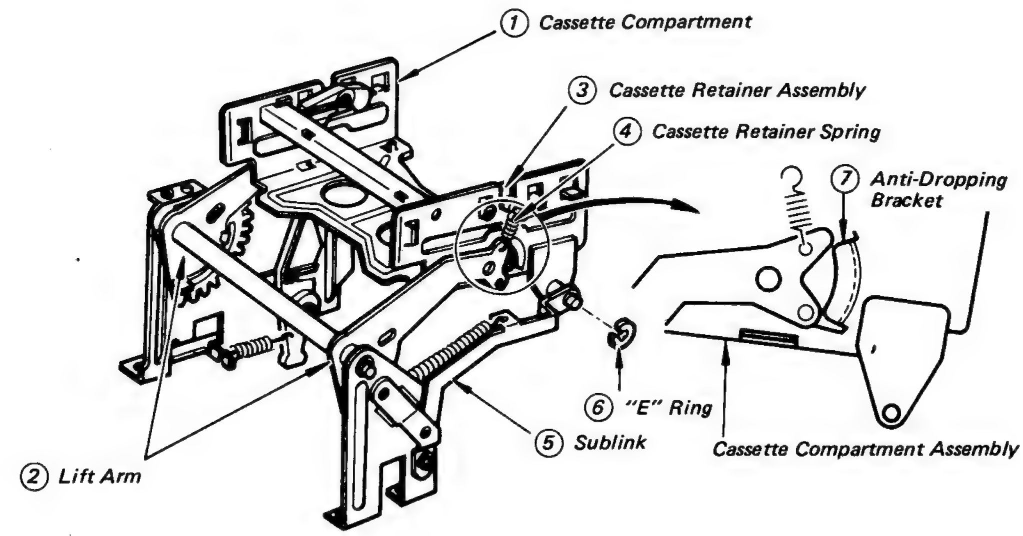


Fig. 5-11 Cassette Compartment Assembly Removal

3. Checking, Adjusting, and Replacing the Lifter Assembly

3-1) Checking

Improper lifter assembly installation will cause:

a. When the cassette is put into the cassette compartment, the bottom of the cassette compartment presses up the cassette. The result is that the tape is tangled or the tape cannot be normally transported.

b. The upper cabinet cover and cassette cover cannot be fitted well.

To prevent such failures, check as follows:

1. Remove the upper cover and cassette cover as directed in Section 5-3-1, the "How To Replace the Cabinet and Associated Components".
2. Turn power off.
3. Insert the cassette ① into the cassette compartment to lock.
4. Check whether the clearance between the bottom of the tape cassette, or the top end of the cassette reference post ③, and the bottom of the cassette compartment ② is 2 mm. (see Fig. 5-12).
5. Check whether the tops of the right-hand and left-hand chassis and the top of the cassette compartment is parallel (see Fig. 5-13).

3-2) Adjustment (see Fig. 5-14)

If the lifter assembly is seen of being out of adjustment, proceed as follows:

1. If the cassette compartment ① is too high on the rear side follows:
   a. Loosen the screw ⑤ (TPA3 x 6) holding the link adjust bracket ③.
   b. Insert a bladed screwdriver into the right-hand slit of the link adjust bracket and move the link adjust bracket in the arrow direction (↲) until the cassette compartment is made in parallel with the chassis.
   c. Tighten the screw.
2. If the cassette compartment ① is too high on your side, follows:
   a. Loosen the screw ⑤ (TPA3 x 6) holding the link adjust bracket ③.
   b. Put the bladed screwdriver into the left-hand slit of the link adjust bracket and move the link adjust bracket in the arrow direction (↗) until the cassette compartment is made in parallel with the chassis.
   c. Tighten the screw ⑤.

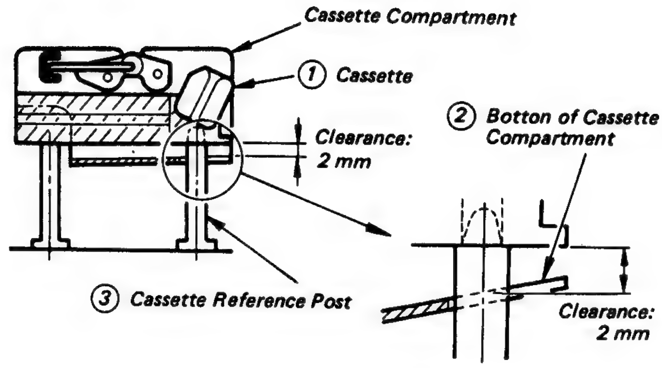


Fig. 5-12 Clearance Between Cassette Bottom and Cassette Compartment Bottom

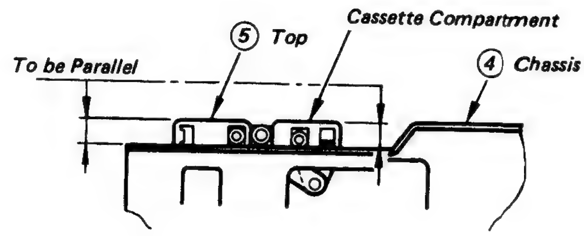


Fig. 5-13 Parallelism of Cassette Compartment Top with Chassis Top

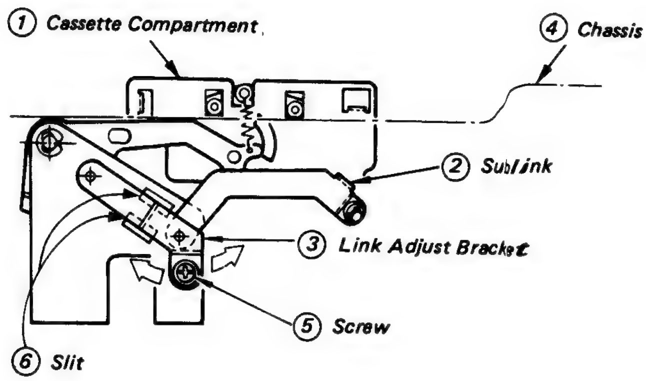


Fig. 5-14 Lifter Assembly Adjustment

3-3) Replacement (see Fig. 5-15)

Removal

1. Press the EJECT button to raise up the cassette compartment.
   NOTE: The lifter assembly can be removed with leaving the cassette compartment installed.
2. Turn power off.
3. Remove the upper cabinet cover, front panel, and cassette cover as directed in Section 3-3-1, the "How To Replace the Cabinet and Associated Components".
4. Disconnect the lead wires of the cassette detect switch ② by following Section 3-3-4, the "Checking and Replacing the Damper Assembly".
5. Remove the cassette compartment as directed in Section 3-3-2, the "Replacing the Cassette Compartment Assembly".
6. Unhook the lifter spring ③ from the lift arm ④.
7. Remove the four screws ⑦ holding each of the left-hand and right-hand lifter brackets ⑤ and ⑥.
8. Lift the lifter assembly straight up for removal.

Installation

To reassemble the lifter assembly, reverse Steps 1 through 8 above. In reassembly, the loading disk should be set on the way of loading to assure that the unlock slider located at the bottom of the reel drive chassis can be engaged with the locker ⑧.

NOTE: The unlock slider is positioned depending on the detect lever.

3-4) Checking After Replacement

1. Check to insure that all the four positions on the mounting surfaces of the left- and right-hand lifter brackets ⑤ and ⑥ are correct as specified.
2. Check to insure that the cassette compartment can be locked in a correct position (see Figs. 3-12, 3-13).
3. Check to insure that the locker ⑧ is correctly engaged with the unlock slider.

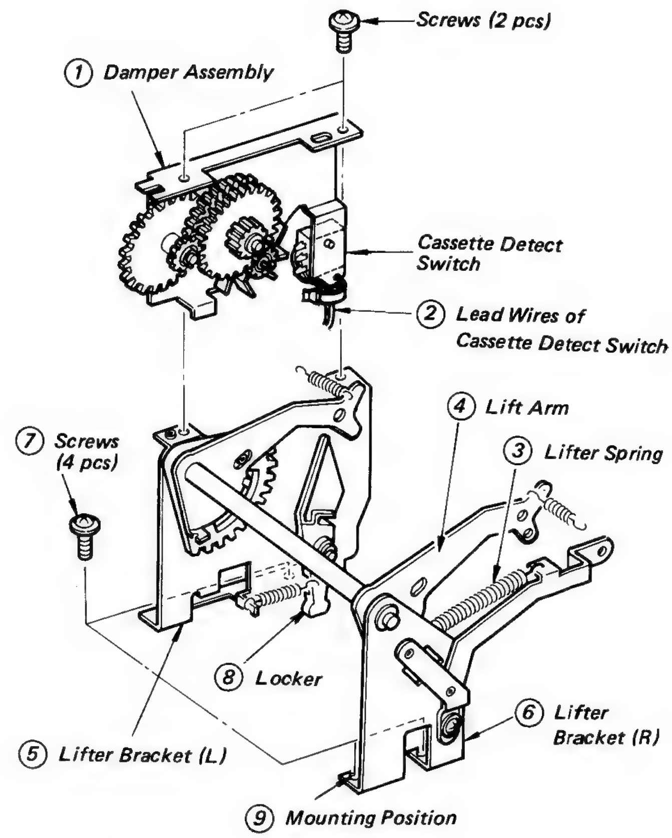


Fig. 5-15 Lifter Assembly Removal

4. Checking and Replacing Damper Assembly

4-1) Checking (Fig. 5-16)

Improper damper assembly installation can cause:

a. Wrong operation of the cassette detect switch.
b. No soft ejection.

To prevent such failures, check as follows.

1. Check that the damper assembly is installed at a correct position for fittings of the upper positioning dub ② and the steady rest ③ of the left-hand lifter bracket (L) ①.
2. Check that the lifter gear is correctly engaged with the damper input gear ④. The top clearance should be 0.3 to 0.6 mm.
3. Check that the lead wires ⑥ from the cassette detect switch ⑤ do not touch the wind gear ⑦ and the like.

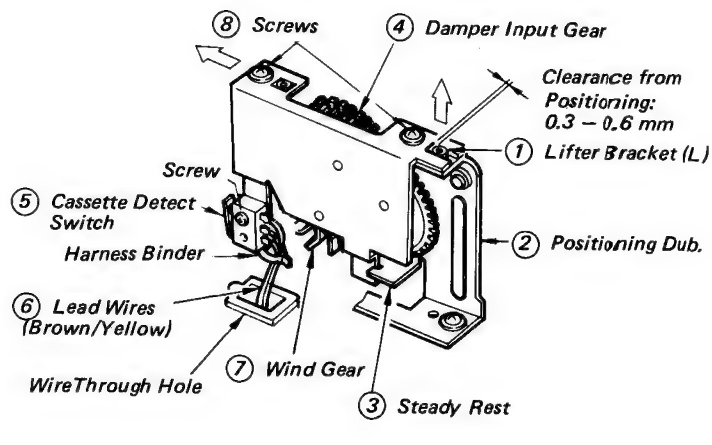


Fig. 5-16 Damper Assembly Removal

4-2) Replacement

Removal (Fig. 5-16)

1. Press the EJECT button to raise up the cassette compartment assembly, and set the VCR to the loading end state by turning the loading motor pulley.
2. Disconnect the lead wires ⑥ (yellow and brown) of the cassette detect switch ⑤ from the 3-pin connector on the Control board to make them free.
3. Remove the two screws ⑧ holding the damper assembly.
4. Move the damper assembly in the arrow direction (←) until the damper input gear ④ is disengaged from the lifter gear.
5. Lift the damper assembly upward (↑) by holding the positioning dub ② with it inclined.

Installation

To reassembly, reverse Steps 1 through 5.

CAUTION: 1. In installation, particular care should be exercised to prevent the actuator of the cassette detect switch ⑤ from striking the detect sublever and the like, or these could be damaged.
2. After installation, the lead wires should be neatly held by the harness binder to remove slack.

Checking After Installation

After replacement, check the damper assembly installation as directed above.

Make certain that the cassette detect switch functions appropriately and that the cassette holder is effectively dampened when raised up.

5. Checking and Replacing the Cassette Detect Switch

5-1. Checking (Figs. 5-17, 5-18)

Malfunctioning cassette detect switch prevents tape loading and unloading. Check and replace the cassette detect switch, if required, as directed below. Note that no adjustment can be made on the cassette detect switch.

Checking

1. Set the loading disk in the unloading end state.
2. Turn power off.
3. Make the cassette compartment lock. (with out Cassette)
4. Press the cassette detect slider downward. The detect lever ① will move counterclockwise. The detect sublever ⑤ at the end, in turn, presses the actuator of the cassette detect switch ⑥ to turn on. (see Fig. 3-18)
5. Turn power on.
6. Check to insure that the cassette detect switch is not turned off during loading.
7. Press the EJECT button again and check to insure that the cassette detect switch cannot be turned off during unloading.
8. Also, check to insure that after the cassette compartment has been raised up, the detect sublever is securely detached from the actuator of the cassette detect switch.

5-2. Replacement

Removal

1. Remove the damper assembly by following Section 3-3-4, the "Checking and Replacing the Damper Assembly".
2. Cut out the harness binder.
3. Remove the screws holding the cassette detect switch.

Installation

To reassemble, reverse Steps 1 through 3 above.

CAUTION: The lead wires of the cassette detect switch should be securely held by the harness binder and harness holder not to allow any slack.

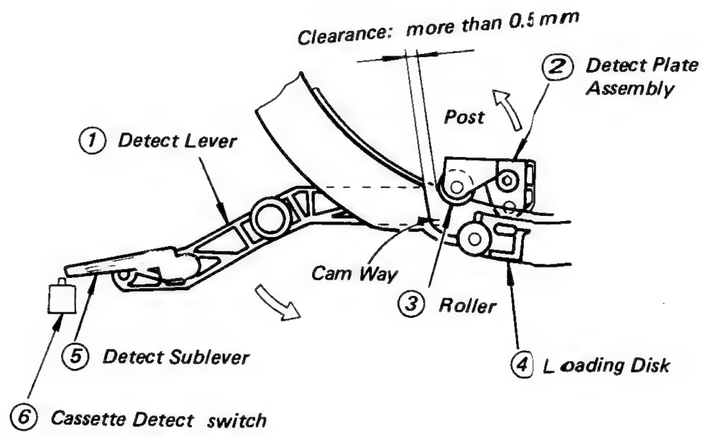


Fig. 5-18 Clearance Between Loading Disk Cam Way Corner and Roller at Time when this goes away

6. Checking, Adjusting, and Replacing the Detect Lever

6-1. Checking (Fig. 5-18)

Improper detect plate assembly installation can cause prevents normal tape loading and unloading or can result in raising the cassette compartment on the way of tape loading or unloading. To prevent such a failure, check as follows:

Checking (see Fig. 5-18.)

1. Remove the upper cover and cassette cover as directed in Section 5-3.
2. Turn power on.
3. Press the cassette compartment down to lock.
4. Also, press the cassette detect slider downward.
   The detect lever ① will move counterclockwise. The roller ③ of the detect plate assemble ②, in turn, goes away from the cam way on the loading disk ④. At the same time, the detect sublever ⑤ on the opposite side presses the actuator of the cassette detect switch ⑥ to turn on. This starts the tape loading.
5. Check to insure that when the roller ③ goes away from the cam way on the loading disk ④, the clearance between the roller ③ and the corner of the cam way is 0.5 mm.
6. Also, check to insure that in loading, the clearance between the cam way and roller ③ is 0.2 to 0.4 mm.
7. Press the EJECT button and check to insure that in unloading, the cassette detect switch ⑥ cannot be turned off.

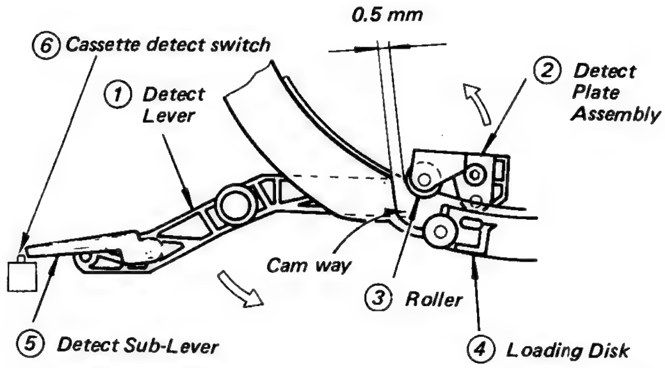


Fig. 5-18 Clearance Between Loading Disk Cam Way Corner and Roller at Time when this goes away

6-2. Adjustment (see Figs. 5-18, 19)

If the detect lever is seen to fail to function normally as the result of checking above, probable causes are:

a. Improper installation of the detect plate assembly ②.
b. Incorrect clearance of the loading disk guide roller.
   NOTE: For the latter cause b, measures will be explained in Section 5-3-7.

To adjust the detect plate assembly ②, proceed as follows:

1. Set the Loading disk ④ in the loading end state by pressing the cassette detect slider.
2. Loosen the screw ⑥ holding the detect plate assembly ② a few times revolution.
3. Put a bladed screwdriver ⑦ into between the detect lever ① and detect lever plate assembly ② and using it, move the detect plate assembly ② in the arrow direction (←) until the loading disk can way ④ and roller ③ are cleared 0.2 to 0.4 mm their between.
4. Tighten the screw ⑥ using a hexagon wrench key.

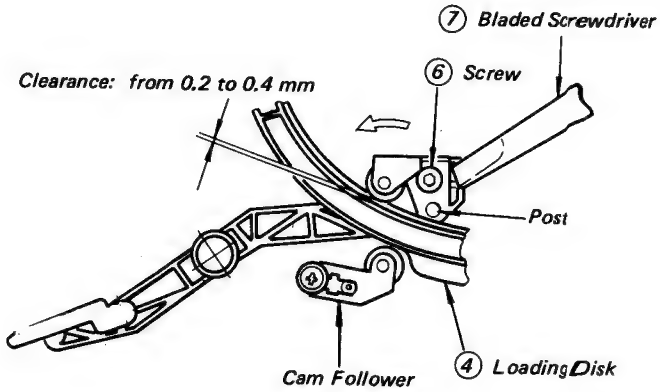


Fig. 5-19 Clearance Between Loading Disk Cam Way and Roller in Loading

6-3. Replacement (see Figs. 5-19, 20)

Removal

1. Press the EJECT button to raise the cassette compartment ⑧ up with power on.
2. Unlock the band brake at the hook end.
   NOTE: Care should be taken not to break the band brake. (3-3-28)
3. Also, unhook the tension spring. (3-3-28)
   NOTE: Remember the hook position.
4. Remove the T-type cam follower.
5. Remove the loading disk ④ by following Section 3-3-7.
6. Unhook the detect spring ⑩ provided between the detect sublever ⑤ and unlock slider ⑨.
7. Take out the detect lever ① for removal.

Removal of Detect Plate Assembly Only

1. Press the EJECT button to raise the cassette compartment ⑧ up.
2. Press the cassette detect slider ⑪ downward to bring the roller ③ away from the cam way on the loading disk ④.
3. Remove the screw ⑥ holding the detect plate assembly ②.
4. Lift the detect plate assembly ② straight up from the post on the detect lever ①.

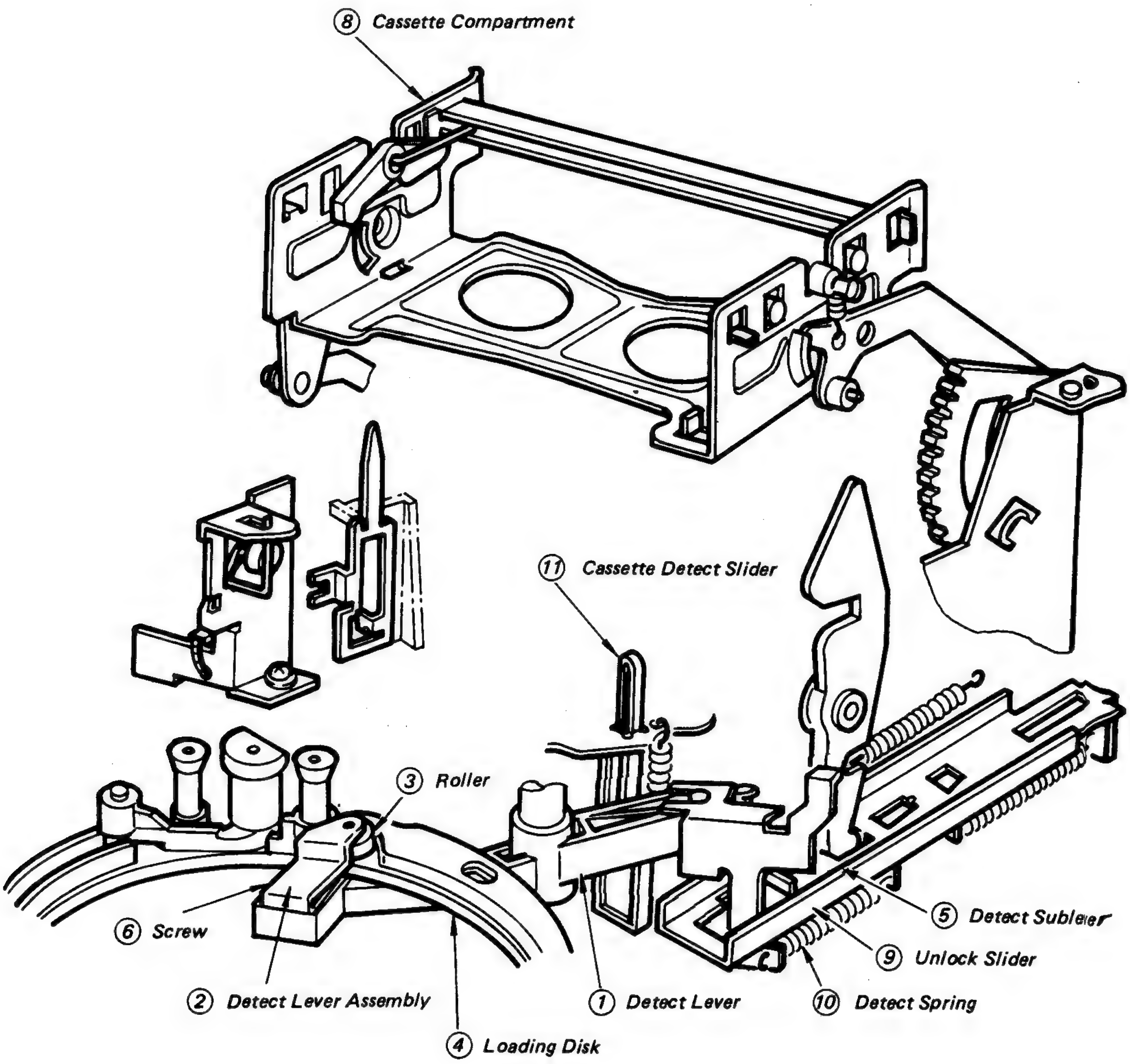


Fig. 5-20 Detect Lever Removal

7. Loading Drive Section

The loading drive assembly and associated arrangements, if not adjusted well, could cause too high tension to tape, too long time for loading or unloading operation, or in particular case no loading nor unloading. In such events, adjust them as directed below:

7-1. Checking in loading mode.

1. Put a cassette into the cassette compartment.
2. Press the cassette compartment for loading.
3. Make certain that the loading disk turns counterclockwise to bring the tape out.
4. Also, make certain that it takes 4.6 seconds or less to fully load the tape.
5. If not, check as follows:
   a. First, check whether the loading motor rotates or not.
   b. If not, the electric circuit can be suspected. Check:
      - Cassette detect switch (refer to Section 5-3-5).
      - Capacitor put through the shielding plate assembly.
      - Loading motor drive circuit.
      - Loading motor.
6. If the loading motor is normal, but does not serve for tape loading or takes too much time, then the mechanical arrangements can be suspected. Check the loading disk for:
   a. Improper engagement of the loading gear with loading disk gear.
   b. Too high load to the loading disk.

   Then, follows:

   b-1. Disengage the loading gear from the loading disk.

   b-2. Turn the loading disk by hand to check whether this can be turned rather freely or not, with it on the way of loading or unloading.

   CAUTION: The four tabs must be used for turning the loading disk. Do not use the return guide, or this can be deformed.

   If it can be turned lightly, the loading disk will be good.
7. If not, check that:
   a. The disk guide rollers, the detect plate assembly roller, the cam follower plate assembly roller, and T-type cam follower assembly roller should be rotated.
   b. Clearance between the disk guide rollers and the loading disk.
   c. Clearance between the detect plate assembly roller and the loading disk.
   d. Engagement of the cam follower plate assembly roller with the loading disk.
   e. Engagement of the T-type cam follower plate assembly roller with the loading disk.
   f. Clearance between the pinch roller lock assembly pinch lock plate and the loading disk.
   g. The tape slack detect lever should not be caught on the loading disk.
   h. Position of the pinch roller guide plate.
8. After completing the above checks, rearrange the loading disk gear and loading gear so that these can be engaged properly.
9. Move the loading drive assembly.

   If the tape cannot be normally loaded even after checking and adjustment are completed as directed above, then check loading belt.
10. If the loading belt is good, then replace the loading drive assembly.

7-2. Checking in unloading

1. Press the EJECT button.
2. Make certain that the loading disk is turned clockwise to see that the tape is rewound in.
3. Also, make certain that it takes 5 seconds or less to fully unload the tape.
4. If not, check in ways similar to those of Item 7-1, the "Checking in loading", above.
5. Also, check the installation position of eject solenoid (refer to Section 5-3-23).

7-3. Checking and adjusting the gear engagement of loading drive assembly and loading disk

If the top clearance between the tooth crest and bottom land of the gears of the loading drive assembly and the loading disk is too little, this can cause high loads in loading or unloading. In a particular case, loading or unloading can be impossible. If the clearance is too large, on the other hand, the gears can be out of engagement at the end of loading or unloading. Check and adjust as follows:

Checking

1. Turn power switch off.
2. Remove the upper cover.
3. Rotate the loading disk by turning the Loading motor pulley ⑤ with hand until the peep hole comes to the position of gear engagement. For the purpose, the peep hole should be brought to the vicinity of the gear engagement by ordinary loading operation and should be precisely adjusted by manually turning the motor pulley or worm clutch pulley.
4. Check to insure that the top clearance is in the range of standard (0.1 to 0.3 mm) by seeing toward from the peep hole.

Adjustment (see Fig. 5-21)

If the top clearance is out of the standard, adjust the position of the loading drive assembly ② as directed below:

1. Put the loading disk ① in position where its gear is to be engaged with that of the loading drive assembly ②.
2. Loosen the two screws ③ holding the loading drive assembly ②.
3. Insert a bladed screwdriver into the clearance between the reel drive chassis ④ and the cut-out of the loading drive assembly ②.
4. Adjust the screwdriver until the top clearance between the gears is 0.1 to 0.3 mm.
5. Firmly tighten the screws ③.

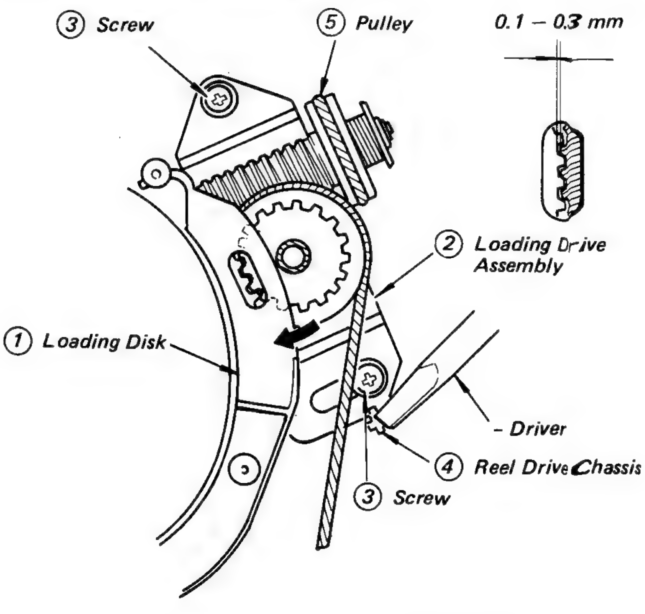


Fig. 5-21 Loading Drive Assembly Adjustment

7-4. Checking and adjusting the loading disk guide roller assembly

If the clearance between the loading disk and disk guide roller assembly is too narrow or wide, this causes loose or stopping movement of the loading disk in loading or unloading. In such an event, check as directed below:

Checking

1. Turn power off.
2. Remove the upper cover.
3. Loosen the two screws holding the loading drive assembly.
4. Disengage the gears of the loading disk and loading drive assembly.
5. By holding either of the four manual drive posts on the loading disk by hand, check to insure that the loading disk can freely rotate both in the loading direction (counterclockwise) and the unloading direction (clockwise).
6. Also, make certain that the loading disk radial looseness should be within 0.2 mm.

Adjustment (see Fig. 5-22)

If the loading disk cannot be turned freely or is too loose, adjust the disk guide roller assembly as directed below:

1. Loosen the screw ② holding the disk guide roller assembly ①.
2. Adjust the position of the disk guide roller assembly ① until the loading disk③ can be rotated freely as checked by one hand, while turning the disk guide roller assembly ① in the arrow direction (↙) by the other on the point A.
3. Tighten the screw ② to hold the guide roller assembly ① where the loading disk ③ has 0.2 mm radial looseness.
4. Make certain again that the loading disk③ can be rotated freely.

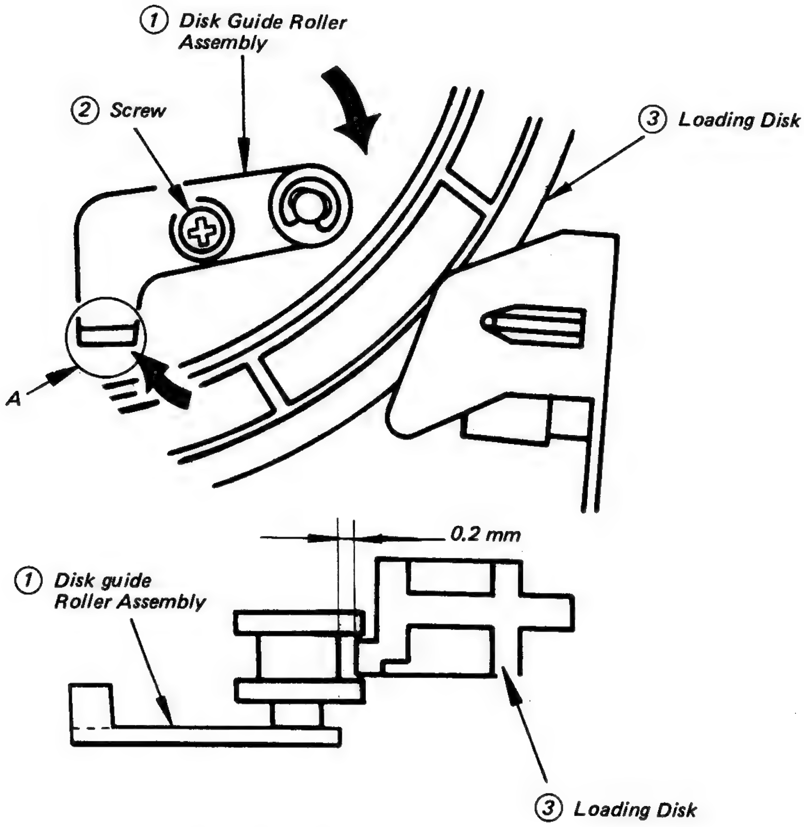


Fig. 5-22 Disk Guide Roller Assembly Adjustment

7-5. Replacing the loading drive assembly (see Figs. 5-23, 5-24 and 5-25)

1. Remove the Tuner block (refer to 5-3-1).
2. Unsolder the lead wires of the shield plate assembly ① at the terminals on the loading motor assembly ②.
3. Loosen the screw ③ and take out the shilding plate assembly ① away from the motor (see Fig. 5-23).
4. Remove the two screws holding the loading drive assembly ④. (Refer to Fig. 5-24)
5. Take out the loading drive assembly ④ away from the loading disk ⑤ (see Fig. 5-24).
6. By holding manual drive post on the loading disk ⑤, turn the position where there is no cam way on the outside of the loading disk ⑤, or in the vicinity of the pinch roller lever assembly ⑥, so as to be over the loading drive assembly (see Fig. 5-24).
7. Remove the take up belt ⑦ by sliding it off the pulley on the helical gear pulley ⑧. Care should be taken not to apply any grease or oil to the surface of the belt.
8. Take out the loading drive assembly ④ from the window of the right-hand frame ⑨ (see Fig. 5-25).
9. Remove the loading motor assembly ② from the loading drive assembly ④.
10. Replace the loading drive assembly ④ by reversing Steps 1 through 9. The loading drive assembly ④ may be replaced together with the loading motor assembly ②.
11. After replacement, adjust the gear engagement of the loading drive assembly with the loading disk according to Item 7-3 previously.

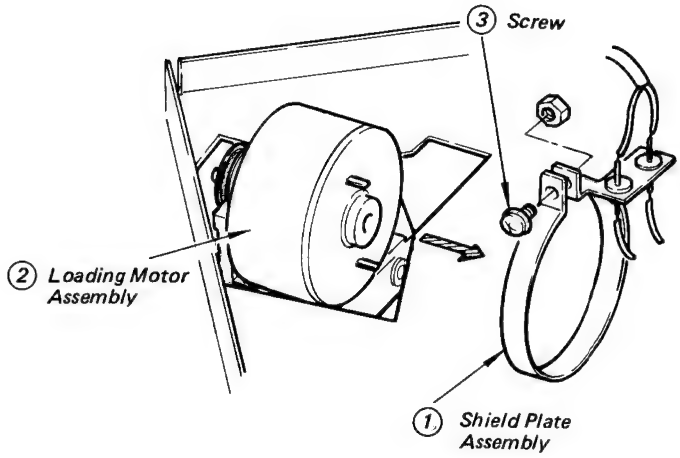


Fig. 5-23 Shielding Plate Assembly Removal

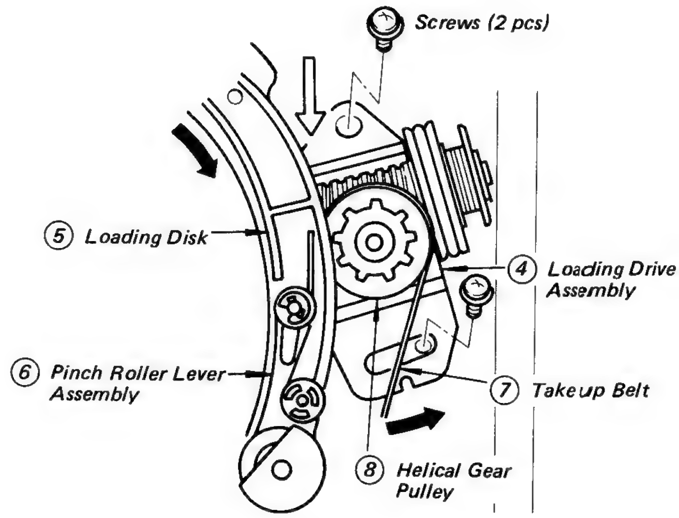


Fig. 5-24 Loading Disk Turning

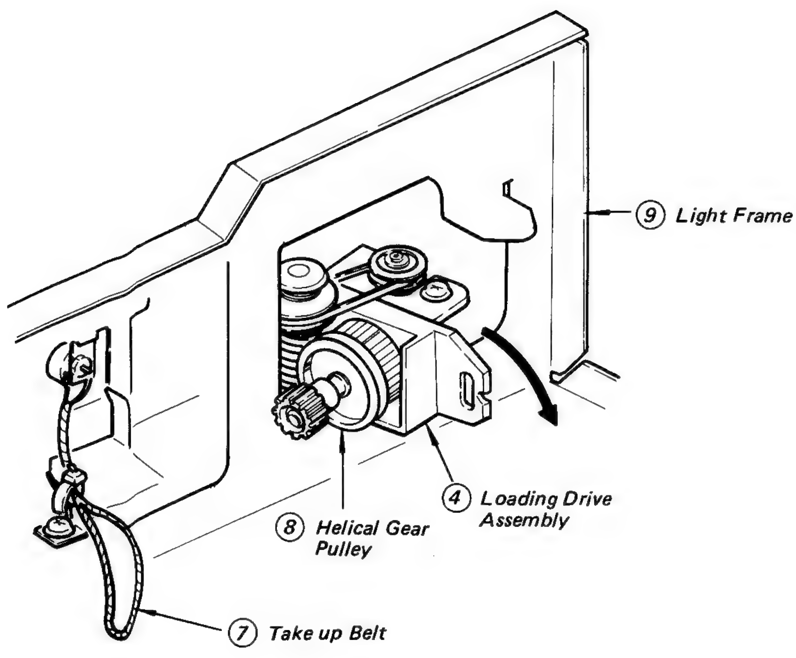


Fig. 5-25 Loading Drive Assembly Removal

7-6. Replacing the loading motor assembly (see Fig. 5-26)

1. Remove the loading drive assembly ① with leaving the lead wires unsoldered at the motor terminals.
2. Remove the loading belt ② by sliding it off the motor pulley.
3. Remove the two screws ④ holding the loading motor assembly ③.
4. Replace the loading motor assembly ③ by reversing Steps 1 through 3.
5. After installation, adjust the gear engagement of the loading drive assembly with the loading disk as in Item 7-3 previously.

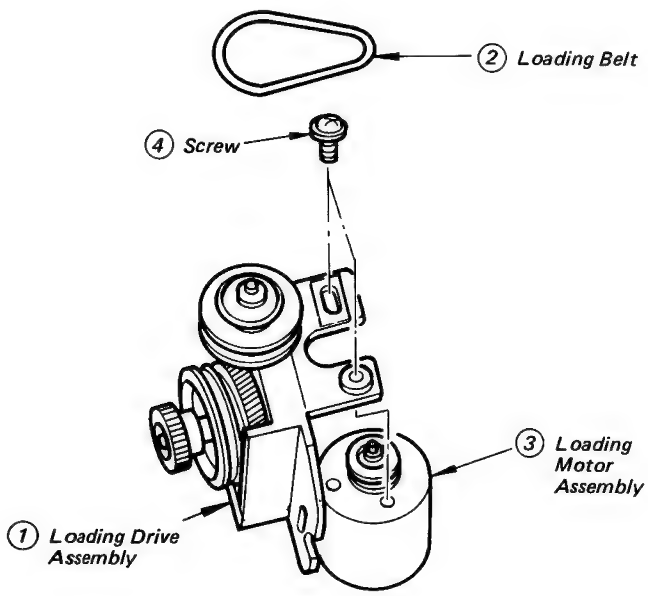


Fig. 5-26 Loading Motor Assembly Removal

7-7. Checking and adjusting the loading end detect switch

The loading end detect switch, if not adjusted properly, will not allow loading to end in time, or stops loading too fast, or will not stop the loading motor in the right time of loading end. To assure the function of the loading end detect switch, follows:

Checking

1. Remove the upper cover.
2. Insert a cassette into the cassette compartment and press it downward to start loading.
   NOTE: If no cassette is available, follow Section 5, the "Operating without Cassette".
3. Check to insure that the loading motor stops at the same time as or a rather little before the loading disk assembly completes loading.

Adjustment (see Fig. 5-27)

If the loading end detect switch does not function in time, adjust its position as follows:

1. Loosen the screw ⑤ holding the loading end detect switch ①.
2. Move the switch by pressing it rightward (→) with use of a bladed screwdriver.
3. Turn power on.
4. Wait until loading ends.
5. Turn power off.
6. Move the switch rightward (→) until a click is heard, using the bladed screwdriver.
7. Further move the switch 0.5 mm.
8. Firmly tighten the screw ⑤.

7-8. Replacing the loading end detect switch (see Fig. 5-28)

1. Remove the screw ③ holding the detect switch bracket ②.
2. Unsolder the lead wires going to the loading end detect switch ①.
3. Remove the screw holding the loading end detect switch ①.
4. Remove the switch by reversing Steps 1 through 3.
5. Follow the "Adjustment" procedures in Item 7-7 above.

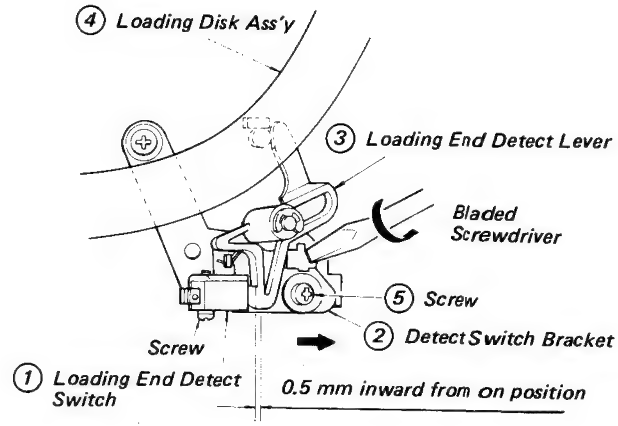


Fig. 5-27 Loading End Detect Switch Adjustment

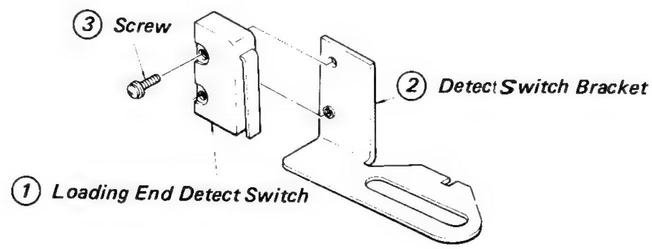


Fig. 5-28 Loading End Detect Switch Removal

7-9. Checking and adjusting the pinch roller lever assembly (see Fig. 5-29)

Scratched, abraded, or loosely revolving pinch roller or guide roller can cause uneven tape running wear on the surface of the tape. To prevent such failures, proceed as follows:

Checking

1. Check the pinch roller for dirt, scratches, abrasion, and axial looseness. Note that the radial looseness is allowed. For dirt, clean the pinch roller. For other defects, replace.
2. Turn the pinch roller by finger tips. The pinch roller should be rotated freely without any seizure.
3. Make certain that the pinch roller lever is free of too much axial looseness and the pinch roller spring is not yielded.

7-10. Replacing the pinch roller lever assembly (see Fig. 5-29)

1. Remove the "E" ring ④ fitting the pinch roller lever assembly ①.
2. Lift the pinch roller lever assembly ① straight up.
3. Wipe to clean the surface of the pinch roller and associated parts using the isopropyl alcohol.
4. Assemble the pinch roller lever assembly ①.
5. Playback the alignment tape and make certain that picture is normally reproduced.

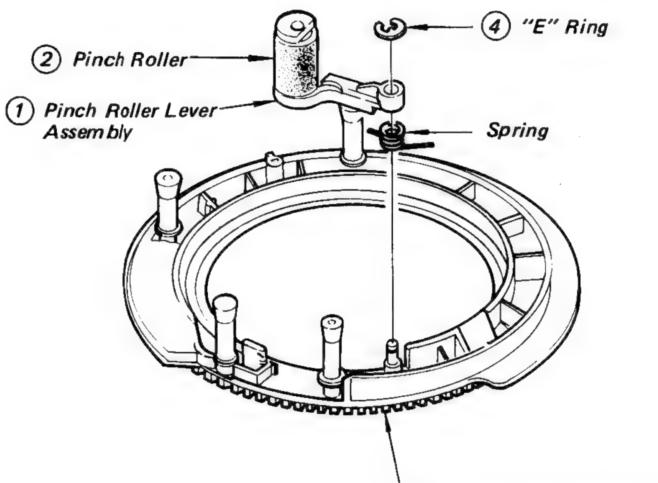


Fig. 5-29 Pinch Roller Lever Assembly Removal

7-11. Replacing the loading disk assembly (see Fig. 5-30)

1. Remove the pinch roller guide plate ①.
2. Loosen the two screw holding the loading drive assembly ②.
3. Take the loading drive assembly ② away from the loading disk assembly ③.
4. Turn the cam follower plate assembly ④ in the arrow direction (↘).
5. Holding the manual drive post, turn the loading disk assembly ③ until the pinch roller lever assembly ⑤ can detached from the pinch roller lock assembly ⑥.
6. In turn, loosen the two screws ⑦ holding the pinch roller lock assembly ⑥.
7. Turn the T-type cam follower plate assembly ⑧ in the arrow direction (↖) to turn the tension lever assembly ⑨ in the arrow direction (↘).
8. Remove the screws holding the sensing coil mounting bracket ⑩.
9. Take and put the sensing coil ⑪ onto the upper cylinder ⑫.

   CAUTION: Care should be exercised not to scratch the sensing coil.
10. In turn, loosen the screws holding the disk guide roller assembly ⑬.
11. Turn the disk guide roller assembly ⑬ in the arrow direction (↖) for detaching from the loading disk.
12. Slide the loading disk assembly ③ in the arrow direction (↑) for detaching from the roller of the detect plate assembly ⑭ and from the roller of the cam follower plate assembly ④.
13. Lift the loading disk assembly ③ straight up for separation.

    NOTE: The loading disk assembly ③ can be detached by bringing to the loading end position.
14. Turn the T-type cam follower plate assembly ⑧ in the arrow direction (↖).
15. Also, turn the tension lever assembly ⑨ in the arrow direction (↘) to fix.
16. Detach the loading disk assembly ③ from the disk guide roller A ⑬ first and from the disk guide roller B ⑬ second.
17. Remove the loading disk assembly ③ from the cassette lid opner ⑮ side first.

    CAUTION: In removing, care should be observed not to scratch the cylinder assembly, heads, tape end sensor ⑯, posts on the tension lever assembly ⑨, discharging wire ⑰, and others.

    NOTE: The loading disk assembly ③ may not be taken out as interfered with by the reinforcing brackets ⑱ and ⑲ depending on the position of the pinch roller lever assembly ⑤. Then, bring the pinch roller lever assembly ⑤ into the position where the pinch roller lock assembly ⑥ had been placed.
18. To reassemble, reverse Steps 1 through 17.

    CAUTION: Installing the sensing coil mounting bracket must be in the correct direction and installing the pinch roller guide plate must be secured.
19. After reassembly, perform the following checkings and adjustments.
    a. Adjusting the pinch roller lock assembly.
    b. Checking the loading end detect switch (refer to Section 7-7).
    c. Adjusting the loading drive assembly (refer to Section 7-3).
    d. Adjust the disk guide roller assembly (refer to Section 7-4).
    e. Checking the detect plate assembly position (refer to Section 5-3-6).
    f. Checking the cam follower plate assembly position (refer to Section 5-3-8).
    g. Checking the engagement of the pinch roller guide plate with the pinch roller lever assembly.
20. After checking and adjustment, confirm the loading time and unloading time and make certain that no defects are seen on the TV screen when the service test tape is played back.

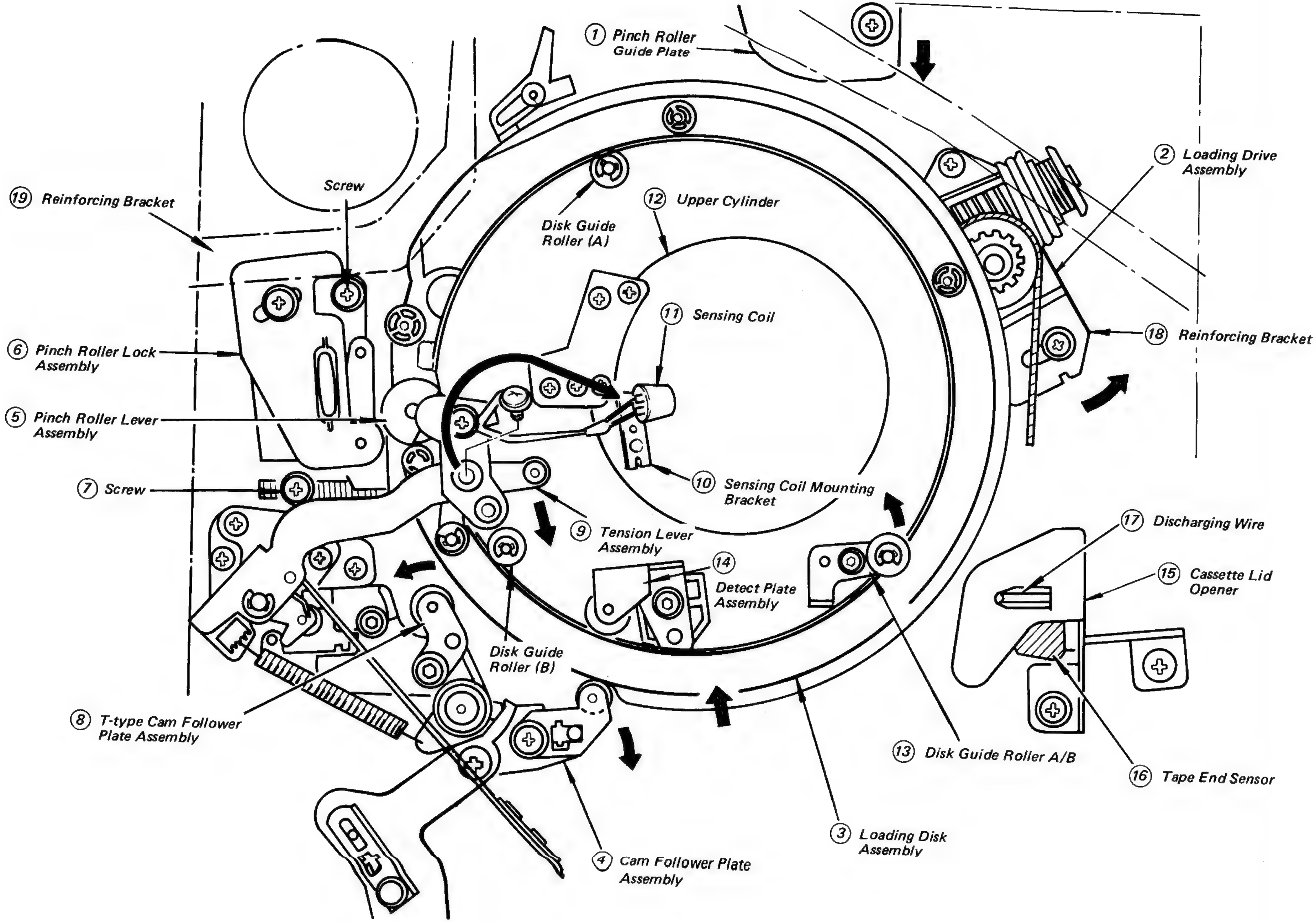


Fig. 5-30 Loading Disk Assembly Removal

8. Checking, Adjusting, and Replacing the Cam Follower

8-1. Checking (see Figs. 5-31, 32)

1. Set the loading disk in loading end state by turning the loading motor pulley with cassette compartment Locked.
2. Check to insure that the clearance between the roller ③ and the cam way on the loading disk ④ is 0.1 to 0.2 mm.
3. Repeat loading and unloading several times to check the clearance is 0.1 to 0.2 mm.

8-2. Adjusting (see Figs. 5-31, 32)

If the specified clearance, 0.1 to 0.2 mm is not obtained, adjust as follows.

1. If the measured clearance is too large, follow.
   a. Loosen the screw ⑤ holding the cam follower plate ②.
   b. Adjust the cam follower plate ② for 0.1 to 0.2 mm clearance.
   c. Tighten the screw ⑤.
2. If the roller ③ is worn too much to provide normal loading and unloading operations, then replace the roller.

8-3. Replacing (Fig. 5-32)

1. Remove the cassette compartment assembly by following Section 5-3-1, the "How To Replace the Cabinet and Associated Components".
2. Remove the screw ⑤ holding the cam follower plate ②.
3. Take out the cam follower plate ②.
4. Temporarily tighten the screw ⑤ to hold the new cam follower plate ②.
5. Put a bladed screw driver into the rectangular hole of the cam follower lever ① to adjust this for 0.1 to 0.2 mm clearance between the roller ③ and cam way on the loading disk ④.
6. Perform clearance checking repeatedly as direc ed above.

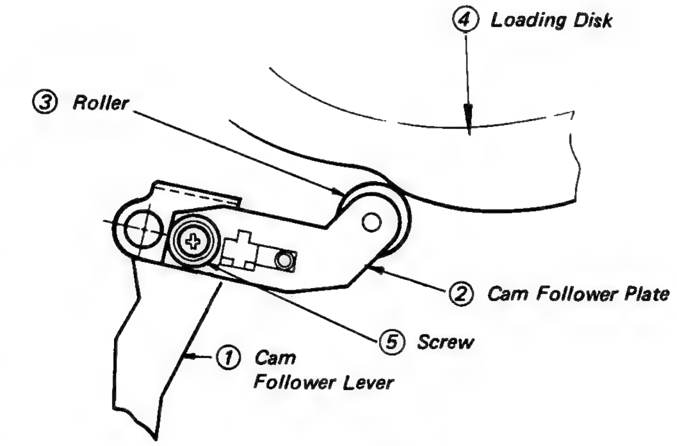


Fig. 5-31 Cam Follower Plate Adjustment

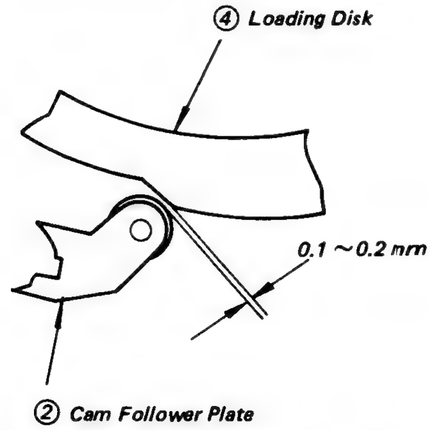


Fig. 5-32 Clearance of Rooler from Loading Disk

9. Checking and Adjusting the Cassette Reference Plate

Improper adjustment of the cassette reference plate causes the cassette to fluctuate loosely. The result is that the tape cannot be normally run. To prevent such a failure, check as follows.

9-1. Checking (Fig. 5-33)

1. Remove the cassette compartment assembly by following Section 5-3-1, the "How To Replace the Cabinet and Associated Components'.
2. Place the cassette reference plate ① in position on the reel drive chassis.
3. Check to insure that the cassette reference plate ① cannot fluctuate up and down (↕), but may be loose within 0.1 mm.

9-2. Adjustment

If the cassette is loose too much, adjust as follow.

1. Place the VCR body on a level, sturdy bench.
2. Keeping the cassette reference plate ① placed in position, loosen the set screw ③ holding the cassette leveler nut ②.
3. Adjust the cassette leveler nut ② until the cassette reference plate ① is free of looseness.

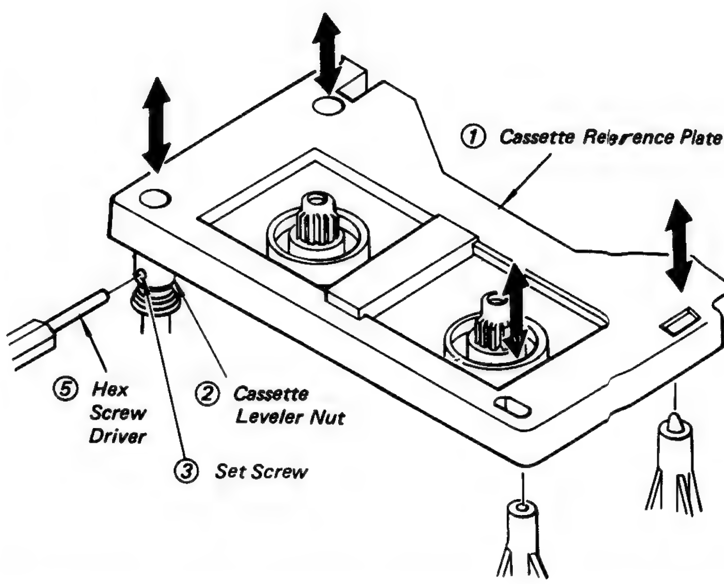


Fig. 5-33 Cassette Reference Plate Adjustment

10. Checking Adjusting, and Replacing the Reel Tables

If the take up or supply reel table is not leveled nor at specified height, this causes tape to tangle, or to step out, in the cassette. Such tangling provides nonuniform tape tension on the next run, resulting in low quality playback or recording. Check as follows.

10-1. Checking (see Figs. 5-34, 35)

1. Put the VCR body on a level, sturdy bench having no looseness.
2. Remove the cassette compartment assembly by following Section 5-3-2, the "Replacing the Cassette Compartment'.
3. Place the cassette reference plate ① in position on the reel drive chassis.
4. Check for cassette reference plate by following Section 5-3-9, the "Checking and Adjusting the Cassette Reference Plate'.
5. While moving the slider Z ④ right and left in the arrow direction, check to insure that the step A of the slider Z does not come in contact with any of the reel table ②, but the step B may touch it.

10-2. Adjusting (Refer to Figs. 5-38, 43)

If the required reel table height cannot be obtained as the result of the checking above, adjust as follows.

1. Remove the reel tables.
2. Add or subtract height adjustment washers.
3. Repeat the checking stated above.
4. If any of the reel tables is defective, then replace it as directed below.

10-3. Replacing the Supply Reel Table (Figs. 5-36 –39)

1. Remove the cassette compartment assembly by following Section 5-3-1, the "How To Replace the Cabinet and Associated Components".
2. Turn the loading drive assembly from the loading start position by hand until the roller ② rides fully on the cam way on the loading disk ③ (see Fig. 5-36).
3. Turn the FR lever holder in the arrow direction (↶) (see Fig. 5-39).
4. Press the tension lever ① on the vicinity of its root so as to turn a little in the arrow direction (↘).
5. Detach the U-shaped hook of the band brake assembly ③ from the stepped post ② (see Fig. 5-37).
6. Turn and hold the FF brake lever ⑥ in the arrow direction (↙) (see Fig. 5-38).
7. Lift the supply reel table ① straight up for removal.

CAUTION: 1. In lifting the supply reel table ①, special care must be exercised not to bend nor break the band brake.

8. Take out any of the adjustment washers ②, washers ③, and thrust bearing ④, if sticked by oil, from the bearing of the supply reel table ①.
9. Wipe the reel table post ⑤ to clean using isopropyl alcohol.
10. Wait for the reel table post ⑤ to dry, and then apply a few drops of oil to it.
11. To reassemble, reverse Steps 1 through 10.

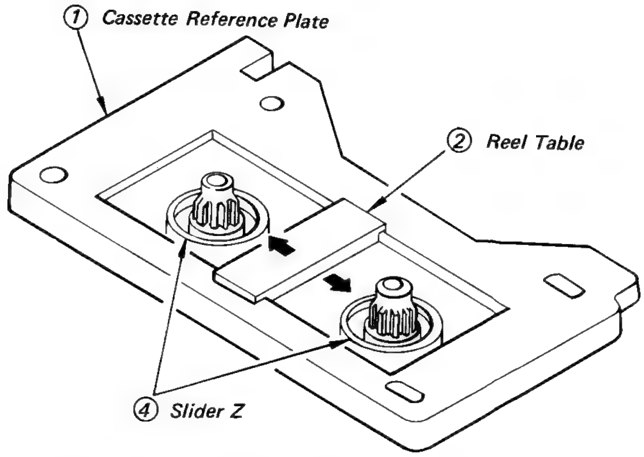


Fig. 5-34 Cassette Reference Plate

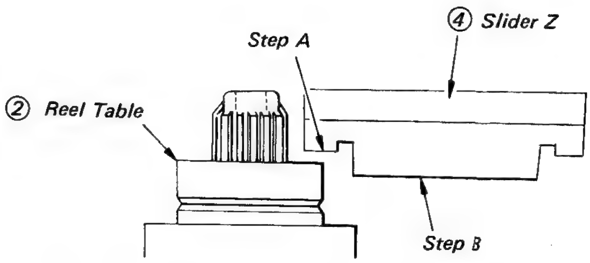


Fig. 5-35 Reel Table Height Checking

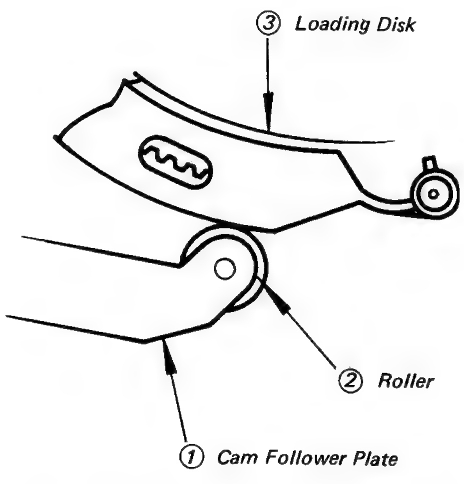


Fig. 5-36 Loading Disk Turning for Removal of Band Brake

10-4. REPLACING THE TAKE-UP REEL TABLE

1. Remove the cassette compartment assembly by following Section 5-3-2. the "Replacing The Cassette Compartment".
2. Set the VCR in the loading end state.
3. While pushing the reel chassis retainer pawl ② in the direction A (→) as if to bend, lift the pause lever ① in the upward direction B (↑) to position as in Fig. 3-40.
4. Also, while pushing the reel chassis retainer pawl ② in the direction A (↘) as if to bend, lift the unloading lever ④ in the upward direction B (↑) to position as in Fig. 5-41.
5. Turn the reel holder in the arrow direction (↱) in Fig. 5-39.
6. Turn and hold the play lever ⑥ in the arrow direction (↰) in Fig. 5-43.
7. Lift the take up reel table assembly ① straight up. (see Fig. 5-43).
8. Take out any of the adjustment washers ②, washers ③, and thrust bearing ④, if sticked by oil, from the bearing of the take up reel table assembly ①.
9. Wipe the reel table post ⑤ to clean using isopropyl alchohol.
10. Wait for the reel table post ⑤ to dry, and then apply a few drop of oil to it.
11. Reassemble the take up reel table assembly ① by reversing Steps 1 through 10.

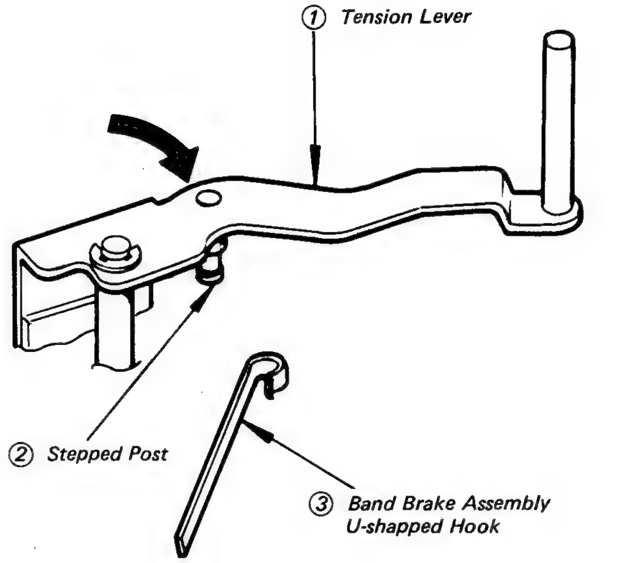


Fig. 5-37 Band Brake Removal

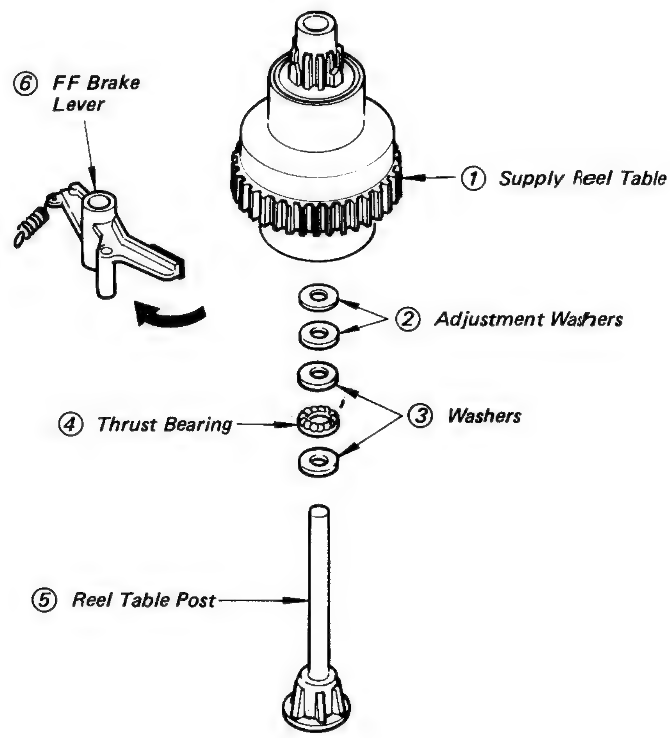


Fig. 5-38 Supply Reel Table Removal

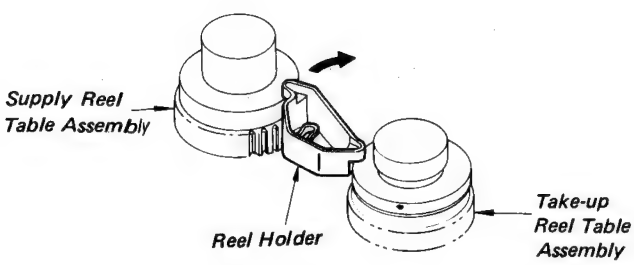


Fig. 5-39 RF Lever Holder Detaching

NOTES: 1. Return the FR lever to the original position (Fig. 5-39).
2. Make certain that the Take-up belt is not slipped off the relay pulley.
3. Also, mount and push the pause lever ① until this cannot be extracted as fastened by the reel chassis retainer pawl ② so that the pause lever ① can be fitted with the pause solenoid plunger ③ as shown in Fig. 5-40.
4. After completing installation of the cassette compartment assembly, perform checking by Item 10-1, the "checking" above.

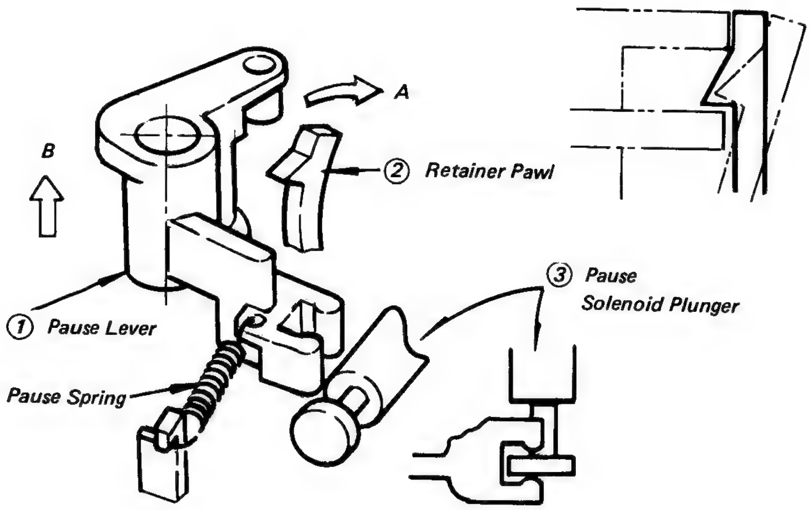


Fig. 5-40 Pause Lever Detaching

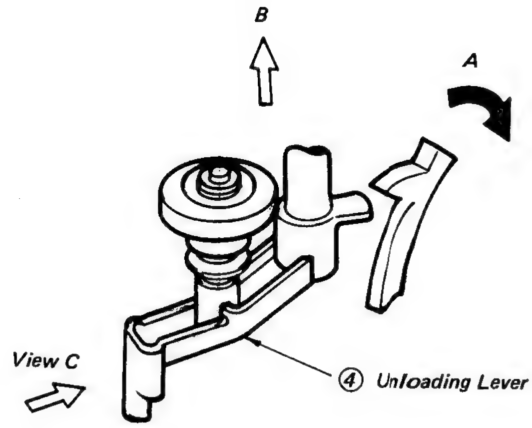


Fig. 5-41 Unloading Lever Detaching

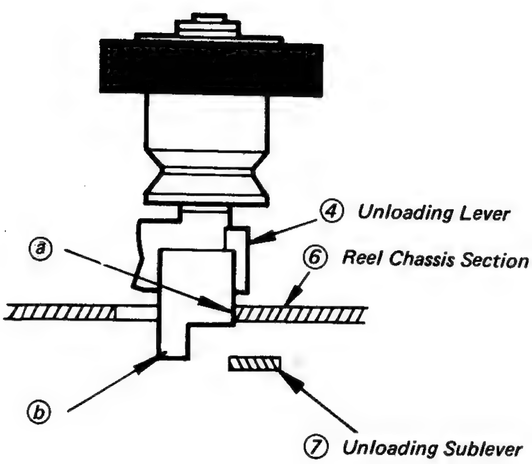


Fig. 5-42 View C Showing Unloading Lever Fitted Withreel Chassis Section

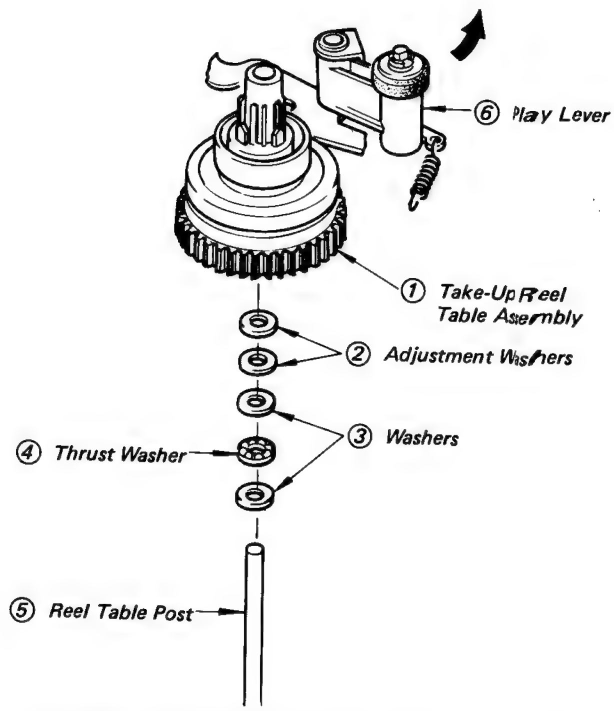


Fig. 5-43 Take-Up Reel Table Assembly Removal

11. Checking and Adjusting the Ejection Winding Torque and Replacing the Associated Components

In cassette ejection, too weak tape winding torque can cause the cassette to fail to take up the tape. The result is that the tape could be damaged. To prevent such a failure, check as follows:

11-1. Checking (see Fig. 5-44)

1. Remove the cassette compartment assembly by following Section 5-3-2, the "Replacing the Cassette Compartment".
2. Set the loading disk in the loading end state.
3. Arrange the forward back-tension measurement jig fixture ② in position on the take up reel table assembly ① .
4. Align the tension gauge ③ so that this can stretch the tape.
5. Set up the VCR in the eject mode of operation.
6. Read the tension gauge ③ to make certain that the take up torque is larger than 60 g.cm.

   NOTE: The winding torque is denoted by T.

   T = Rt x Rg

   Rt: tape radius (cm)

   Rg: read of the tension gauge (g)

11-2. Adjustment

If the winding torque specified above cannot be obtained, proceed as follows:

1. Clean the surface of unloading tyre pulley V groove, loading drive assembly pulley and intermediate pulley V grooves, take-up belt, take-up reel table assembly, and the like.
2. If the unloading tyre rubber is abraded too much, replace as will be directed below.
3. Also, if the take-up belt is elongated too much, replace by following Item (4) below.

11-3. Replacing the Unloading Tyre (Fig. 5-45)

1. Remove the cassette compartment assembly.
2. Slip the take-up belt ② off for removal.
3. Remove the "E" ring ⑥ and the polyethylene slider ⑤ .
4. Replace the unloading tyre ④ by reversing Steps 1 through 3.

   CAUTIONS:
   1. In installing, care should be taken in the correct mounting direction.
   2. Care should be taken not to miss the polyethylene sliders ③ and ⑤ .
   3. Wipe the shaft to clean using isopropyl alcohol. Wait for it to dry. Apply a few drops of oil to it.
   4. Do not touch the unloading tyre surface and take-up belt surface by hand.
   5. Care should be exercised not to apply any oil to them.
5. Perform checking as directed previously.

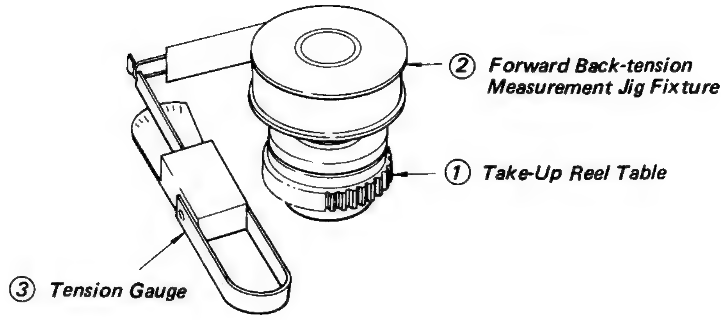


Fig. 5-44 Winding Torque Measurement at Eject Mode

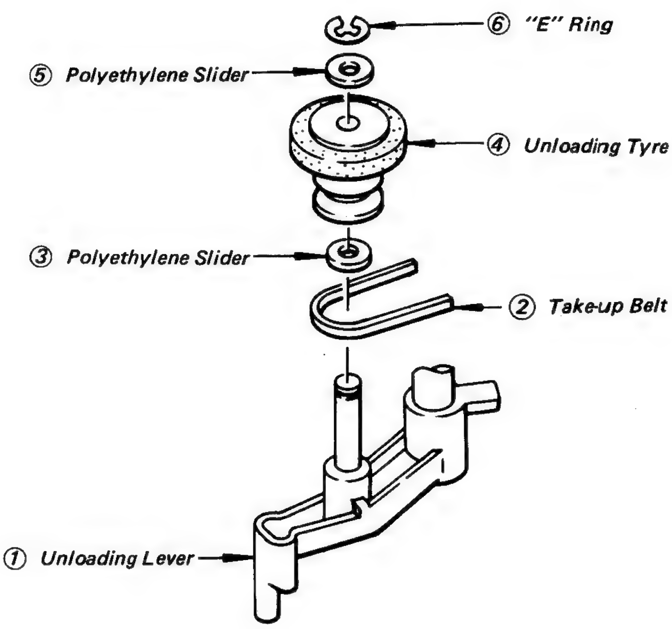


Fig. 5-45 Unloading Tyre Replacement

11-4. Replacing the Take Up Belt (Fig. 5-46)

1. Remove the cassette compartment assembly.
2. Place the concave cam way on the loading disk ① in posotion as shown.
3. Loosen the two screws ③ holding the loading drive assembly ②.
4. Move the loading drive assembly ② in the arrow direction (↘).
5. Remove the take-up belt by slipping off the loading drive assembly ② and unloading tyre ⑤.
6. To reassemble, reverse Steps 1 through 5.

   CAUTIONS: 1. In replacement, do not touch the take-up belt by hand, nor apply any oil to it.
   2. After replacement, check to insure that the take-up belt is properly fitted with the intermediate pulley ④ and with the V groove of the unloading tyre ⑤ as shown.
   3. Check the take-up belt for twist.
7. Adjust the loading drive assembly ② as directed in Section 5-3-7.
8. Perform checking as directed previously.

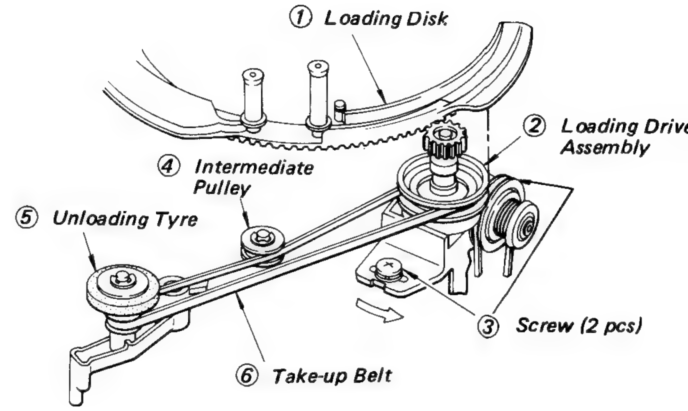


Fig. 5-46 T-U Removal

12. Checking and Adjusting the Rec and Playback Winding Torque and Replacing the Associated Components

In recording or playback, the tape fed out of the supply reel table is finally wound into the take up reel table. Too large winding torque of the take up reel table can cause the tape to undergo excessively large tension, resulting in elongation of the tape. Too weak winding torque, on the other hand, results in no winding of the tape.

12-1. Checking (Fig. 5-47)

1. Put a cassette into the cassette compartment.
2. Playback the cassette for a few minutes for aging.
3. Remove the cassette compartment assembly.
4. Set the loading disk in the loading end state.
5. Install the forward back-tension measurement jig fixture ② in position on the take up reel table assembly ①.
6. Hold the tape slack detect lever by hand to restrain it from moving. This is needed to prevent the VCR from being reset from the playback mode when it is in operation.
7. Align the tension gauge ③ so that this can stretch the tape.
8. Run the VCR in the playback mode.
9. Return the tension gauge ③ at approximately 20 mm/sec according as the tape is wound in.
10. At the same time, read the tension gauge ③ to make certain that the winding torque is in the range from 60 to 160 g.cm.

    NOTE: The winding torque is denoted by T.

    T = Rt x Rg

    Rt: tape radius (cm)

    Rg: read of the tension gauge(g)

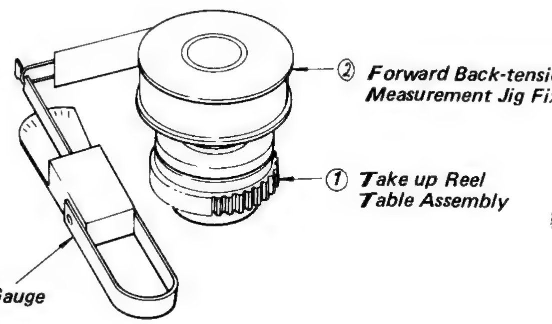


Fig. 5-47 Recording and Playback Winding Torque Measurement

12-2. Adjustment

If the winding torque specified above can not be obtained proceed as follows:

1. Check to insure that the counter belt is not slipped off the intermediate pulley and counter pulley and is not touching wires and any other part.
2. Revolve the take up reel table assembly by hand to check that the counter operates normally. If not, replace the counter (refer to Section 5-3-1).
3. Remove the counter belt.
4. Set up the VCR in the rewinding or review mode.
5. Revolve the take up reel table assembly by hand to check that this can be revolved freely. If not, replace it as will be directed below.
6. Clean the surface of play idler, fast-forward clutch assembly and play pulley V grooves, play belts.
7. If the play idler slips too much on the part of the take up reel table assembly, if the rubber surface is abraded too much, or if the play belt is elongated too much, then replace the play idler and the play belt by following Item 12-3 below.
8. If the winding torque is out of the specified range, replace the take up reel table assembly by following Item 5-3-10.

12-3. Replacing the Play Idler and Play Belt (Fig. 5-48)

1. Remove the cassette compartment assembly.
2. Remove the "E" ring ⑦.
3. Pull the play idler ⑥ straight up for removal.
4. Slip the play belt ② off for removal.
5. To reassemble, reverse Steps 1 through 4.

CAUTIONS:
1. In replacement, care should be taken not to miss the polyethylene sliders ③ and ⑤.
2. Do not touch the surface of the play idler ⑥ and play belt ②, nor apply
3. The play belt ② must not be twisted when installed.

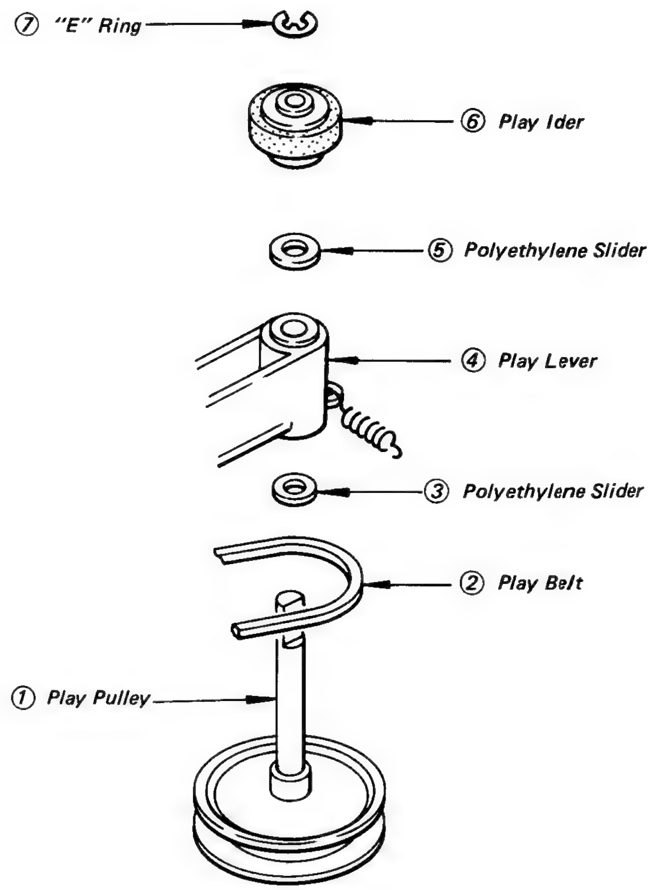


Fig. 5-48 Play Idler and Play Belt Removal

13. Checking, Adjusting, and Replacing the Fast-Forward Solenoid (Adjusting the Fast-Forward Gear)

Bad engagement of the Fast-Forward gear with the take up reel table assembly cannot transmit a required Fast-Forward take up torque in the Fast-Forward mode. Abnormal sound can also occur. To prevent such a failure, check as follows:

13-1. Checking (Fig. 5-49)

1. Remove the cassette compartment assembly.
2. Set the loading disk in the loading end state.
3. Remove the reel belt from the cylinder pulley to make the cylinder revolution free.
4. Set the VCR in the Fast-Forward mode of operation.
   CAUTION: In setting, lightly turn the take up reel table assembly, or one top of the gear interferes with another, sometimes resulting in no plunger attraction of the solenoid.
5. Check to insure that the top clearance of the gears is 0.3 mm (see Fig. 5-49).
6. Too much abrasion of the Fast-Forward gear can result in abnormal driving. Then, replace the Fast-Forward gear by following Item 5-3-15, the "Fast-Forward Gear Replacement", below.

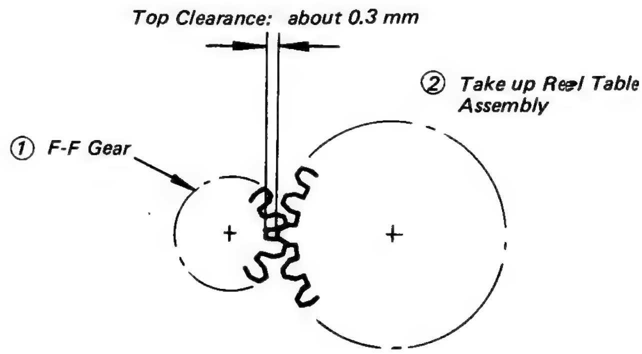


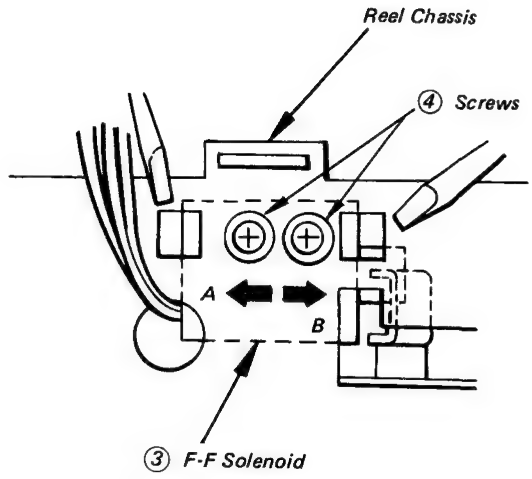
Fig. 5-49 Fast-Forward Gear Engagement Adjustment

13-2. Adjusting the Fast-Forward Gear Engagement (Fig. 5-49, 5-50)

1. Proceed with the above "Checking" procedures, Steps 1 through 3.
2. Loosen the two screws ④ holding the Fast-Forward solenoid ③.
3. Slide the Fast-Forward solenoid ③ in the direction B (→).
4. Set the VCR in the Fast-Forward mode of operation to energize the Fast-Forward solenoid ③.
5. Move the Fast-Forward solenoid ③ by pressing a bladed screwdriver to the rectangular hole on the reel chassis until the gear top clearance is 0.3 mm (see Fig. 5-49).
6. Tighten the screws ④.
7. If the Fast-Forward solenoid ③ is defective in the plunger attraction, then replace the Fast-Forward solenoid ③ by following Item 13-3 below.

13-3. Replacing the Fast-Forward Solenoid

1. Remove the cassette compartment lifter assembly.
2. Also, remove the solenoid drive board assembly.
3. Unplug the connector of the Fast-Forward solenoid ③.
4. Remove the two screws ④ holding the Fast-Forward solenoid ③.
5. Take out the Fast-Forward solenoid ③ together with the plunger.
6. To reassemble, reverse Steps 1 through 5.



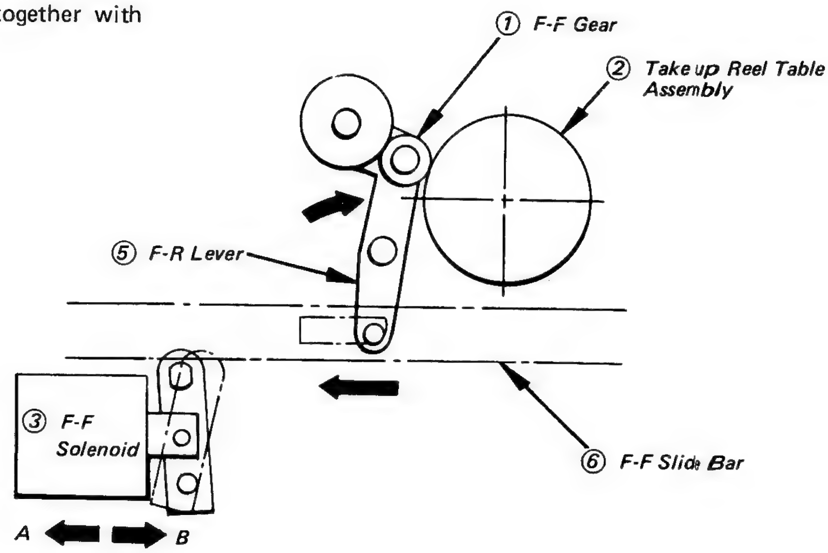


Fig. 5-50 Fast-Forward Solenoid Stroke Adjustment

14. Checking, Adjusting, and Replacing the Rewind Solenoid

Bad engagement of the rewind gear with the supply reel table assembly cannot transmit a required rewind take up torque in the rewinding mode of operation. Abnormal sound can also occur. To prevent such a failure, check as follows:

14-1. Checking (Fig. 5-51)

1. Remove the cassette compartment assembly.
2. Set up the VCR in the loading end state.
3. Remove the reel belt from the cylinder pulley to make the cylinder revolution free.
4. Set up the VCR in the rewidning mode of operation.
   CAUTION: In setting, lightly turn the supply reel table assembly, or one top of the gear interferes with another, sometimes resulting in no plunger attraction of the rewind solenoid.
5. Check to insure that the top clearance of the gears is 0.3 mm (see Fig. 5-51,.
6. Too much abrasion of the rewind gear can result in abnormal driving. Then, replace the rewind gear by following Item 14-4, the "Replacing the Rewind Gear", below.

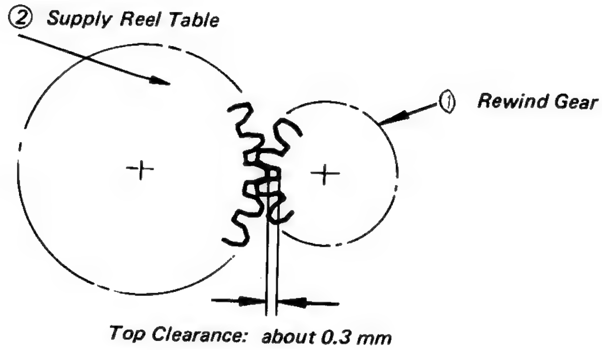


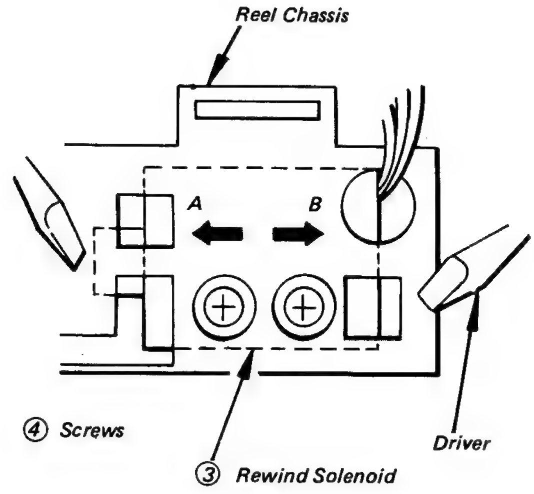
Fig. 5-51 Rewind Gear Engagement Adjustment

14-2. Adusting the Rewind Gear Engagement (Fig. 5-51, 5-52).

1. Proceed with the above "Checking" procedures, Steps 1 through 3.
2. Loosen the two screws ④ holding the rewind solenoid ③.
3. Slide the rewind solenoid ③ in the direction A (←).
4. Set the VCR in the rewinding mode of operation to energize the rewind solenoid ③.
5. Move the rewind solenoid ③ by pressing a bladed screw-driver to the rectangular hole on the reel chassis until the gear top clearance is 0.3 mm (see Fig. 5-51).
6. Tighten the screws ④.
7. If the rewind solenoid ③ is defective in the plunger attention, then replace the rewind solenoid ③ by following Item 14-3 below.

14-3. Replacing the Rewind Solenoid

To replace the rewind solenoid, carry out in a way similar to that of the Fast-Forward solenoid (refer to Section 5-3-13).



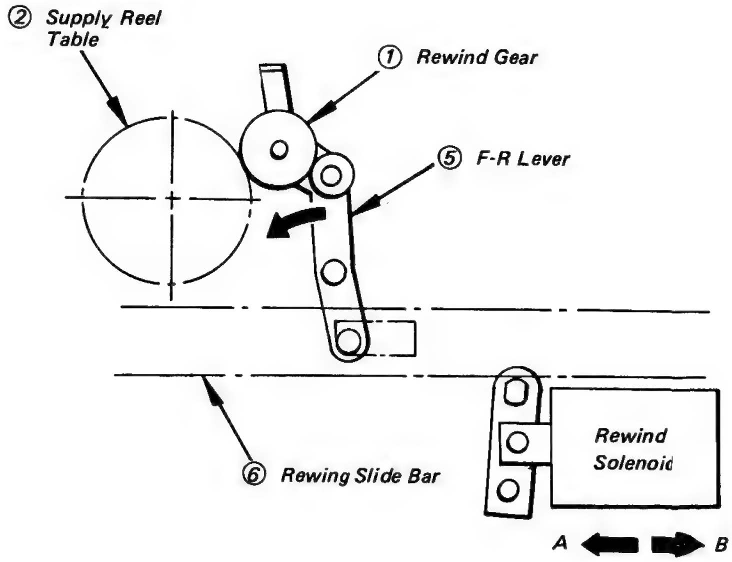


Fig. 5-52 Rewind Solenoid Stroke Adjustment

14-4. Replacing the Rewind Gear (Fig. 5-53)

1. Remove the cassette compartment assembly.
2. Remove the "E" ring ③.
3. Pull the rewind gear ⑤ straight up for removal.
4. To reassemble, reverse Steps 1 through 3.

   CAUTIONS: 1. In replacement, care should be taken not to miss the polyethylene sliders ④ and ⑥.
   2. Wipe the shaft to clean using isoplopyl alcohol. Wait for it to dry. Apply a few drops of oil to it.
5. Proceed with adjustment by following Item 14-2.

CAUTIONS: 1. Care should be taken not to miss the polyethylene sliders ③ and ⑤.
2. Wipe the shaft to clean using the isoplopyl alcohol. Wait for it to dry. Apply a few drops of oil to it.
3. Do not touch the belts by hand, nor apply any oil to them.

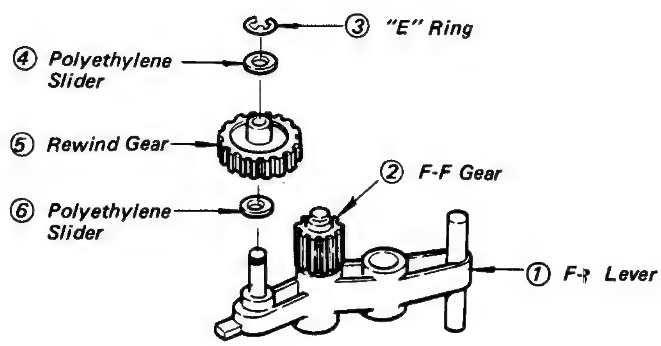


Fig. 5-53 Rewind Gear Removal

15. Checking and Adjusting the Fast-Forward Winding Torque and Replacing the Associated Components

In the Fast-Forward mode of operation, the tape fed out from the supply reel table is wound into the take up reel table. Too weak winding torque can not wind fully of the tape. To prevent such a failure, check as follows:

15-1. Checking (Fig. 5-54)

1. Remove the cassette compartment assembly.
2. Set the VCR in the loading end state.
3. Install the forward back-tension measurement jig fixture ② in position on the take up reel table assembly ①.
4. Align the tension gauge ③ so that this can stretch the tape.
5. Run the VCR in the Fast-Forward mode of operation.
6. Holding the tape stretched by the tension gauge ③, read the tension gauge ③. The winding torque should be 1,000 to 2,000 g.cm.

   NOTE: The winding torque is denoted by T.
   $T = Rt \times Rg$
   Rt: tape radius (cm)
   Rg: read of the tension gauge (g)

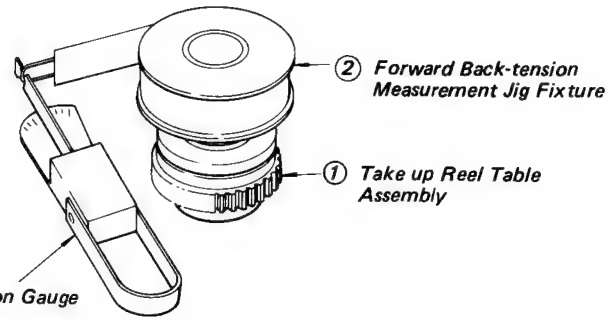


Fig. 5-54 Fast-Forward Winding Torque Measurement

15-2. Adjustment

If the winding torque is out of the range specified above, proceed as follows:

1. Clean the V grooves of the pulleys for the cylinder and the Fast-Forward clutch assembly and planetary gear unit assembly, reel belt and the like.
2. If the reel belt is abraded or elongated too much, then replace by following Item 15-4 below.
3. If the top clearance of the gears is out of the specified value, 0.3 mm, then adjust by following Section 5-3-13.
4. If the Fast-Forward gear is abraded too much or broken, then replace it by following Item 15-3 below.
5. If the measured winding torque is out of the range specified above, then replace the Fast-Forward clutch assembly by following Item 15-3 below.

15-3. Replacing the Fast-Forward Clutch Assembly and Fast-Forward Gear (Fig. 5-55)

1. Remove the cassette compartment assembly.
2. Slip the reel belt ② and play belt ③ off the Fast-Forward clutch assembly ① for removal.
3. Remove the "E" ring ⑧ from the shaft of the Fast-Forward clutch assembly ①.
4. Pull the Fast-Forward gear ⑥ straight up for extraction.
5. Take out the Fast-Forward clutch assembly ① for removal.
6. To reassemble, reverse Steps 1 through 5.

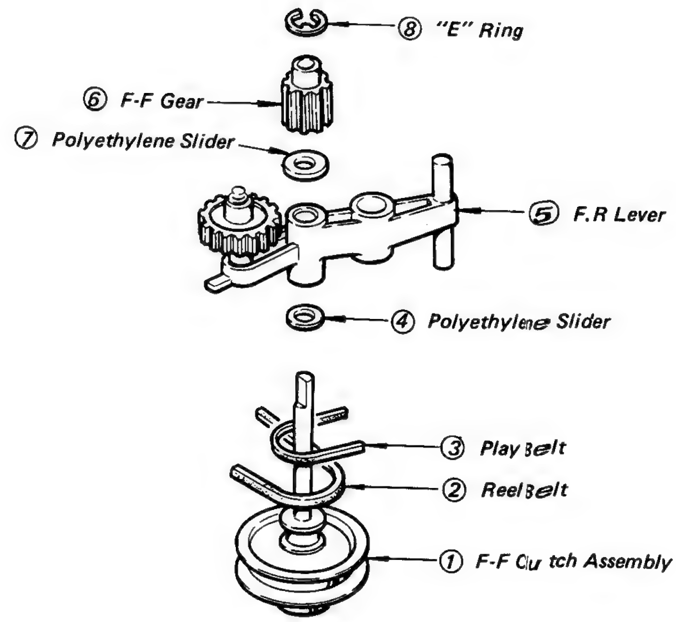


Fig. 5-55 Fast-Forward Clutch Assembly and Fast-Forward Gear Removal

15-4. Replacing the Reel Belt

1. Remove the Video Circuit board.
2. Slip the reel belt ⑤ off the cylinder pulley.
3. Slip the reel belt ⑤ off the Fast-Forward clutch assembly.
4. Slip the reel belt ⑤ in the direction A (↰) out of the drive pulley ③ and stretch it in the direction B (←).
5. Holding the lift arm ④ down by hand, lift the reel belt ⑤ in the upward direction C (↑), release stretching in the direction B, and pull it in the direction D (↗) for removal.
6. To reassemble, reverse Steps 1 through 5.

CAUTIONS: 1. In replacement, care should be observed not to scratch the belt, nor to apply any oil to it.
2. The belt should not be twisted.
3. If oil is applied to the belt, then wipe the belt and pulley V groove to clean using the isoplopyl alcohol.

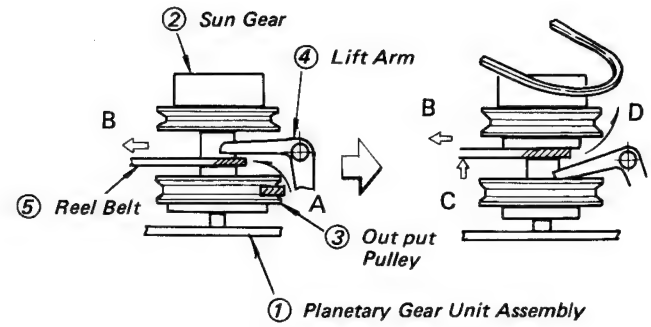


Fig. 5-56 Reel Belt Removal

16. Checking the Rewinding Torque and Replacing the Components

In the rewinding mode of operation, the tape fed out of the take up reel table assembly is rewound into the supply reel table. Too weak rewinding torque the supply reel table can not to rewind fully the Tape. To prevent such a failure, check as follows:

16-1. Checking and Replacing (Fig. 5-57)

Proceed in a way similar to that of Section 5-3-15, the "Checking and Adjusting the Rewinding Take up Torque and Replacing the Rewinding Clutch Assembly and Rewinding Gear".

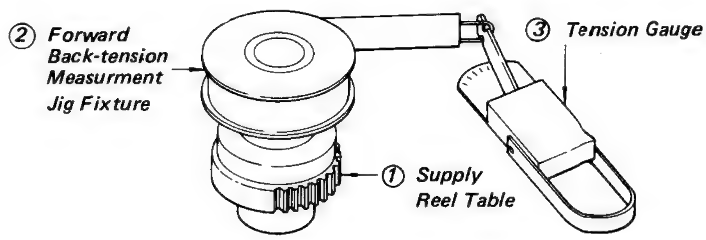


Fig. 5-57 Rewinding Torque Measurement

17. Checking and Adjusting the Supply Brake Torque (Main Brake Torque) and Replacing the Associated Component

Too weak supply brake torque can result in excessive slack at the end of the Fast-Forward or rewinding mode of operation. If, also, can cause the tape to be pulled out from the cassette even in no operation. To prevent such failures, proceed as follows:

17-1. Checking (Fig. 5-58)

1. Remove the cassette compartment assembly.
2. Turn the supply reel table ① several times clockwise by hand for aging.
3. Install the forward back-tension measurement jig fixture ② in position on the supply reel table assembly ① .
4. Read the tension gauge ③ , while stretching the tape at an approximate speed of 18 mm/sec by the tension gauge ③ . The supply brake torque should be higher than 100 g.cm.

NOTE: The supply brake torque is denoted by T.
T = Rt x Rg
Rt: tape radius (cm)
Rg: read of the tension gauge (g)

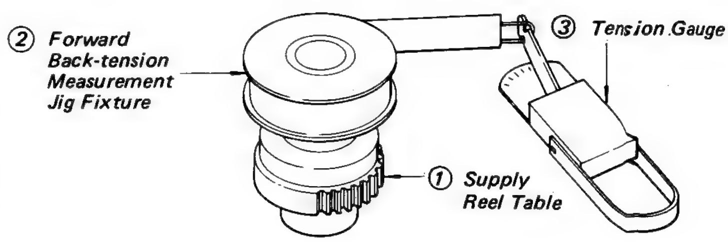


Fig. 5-58 Supply Brake Torque Meausrement

17-2. Adjusting and Replacing the Supply Brake Lever (Fig. 5-59)

If the measured supply brake torque is lower than the value specified above, proceed as follows:

1. Wipe the surface of the supply reel table.
2. Replace the supply brake lever by following Item.

Replacing

1. Remove the cassette compartment assembly.
2. Remove the supply reel table by following Section 5-3-10.
3. Remove the two screws ② holding the F.R lever holder ①.
4. Pull the F.R lever holder ① straight up for removal.
5. Unhook the brake spring ④ from the supply brake lever ③.
6. Pull the supply brake lever ③ straight up for removal from the reel chassis.
7. To reassemble, reverse Steps 1 through 6.

   CAUTIONS: 1. In mounting the supply brake lever ③, fit this in position with the supply brake shift lever ⑤.
   2. Care should be taken in tightening the screws ②, or too firm tightening could break down the opposite component parts female threads.
   3. Do not touch the supply brake felt by hand, nor apply any oil to it.
8. After replacement, proceed with checking as directed above.

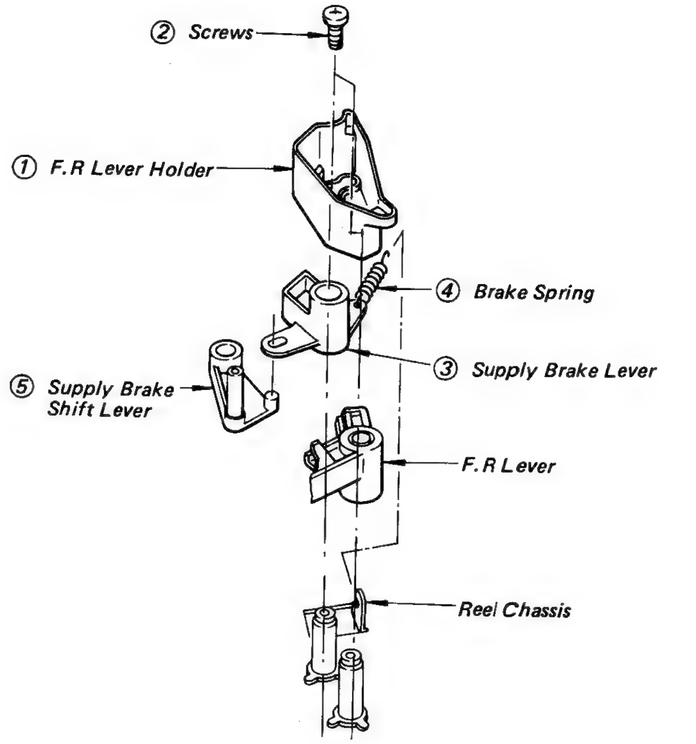


Fig. 5-59 Supply Brake Lever Removal

18. Checking and Adjusting the Take Up Brake Torque (Main Brake Torque) and Replacing the Associated Component

Too weak supply brake torque can result in excessive slack at the end of the Fast-Forward or rewinding mode of operation. It, also, can cause the tape to be pulled out from the cassette even in no operation. To prevent such failures, proceed as follows:

18-1. Checking (Fig. 5-60)

1. Remove the cassette compartment assembly.
2. Turn the take up reel table assembly several times counterclockwise by hand for aging.
3. Install the forward back-tension measurement jig fixture ② in position on the take up reel table assembly ①.
4. Read the tension gauge ③, while stretching the tape at an approximate speed of 18 mm/sec by the tension gauge ③. The take up brake torque should be higher than 100 g.cm.

   NOTE: The take up brake torque is denoted by T.

   T = Rt x Rg

   Rt: tape radius (cm)

   Rg: read of the tension gauge (g)

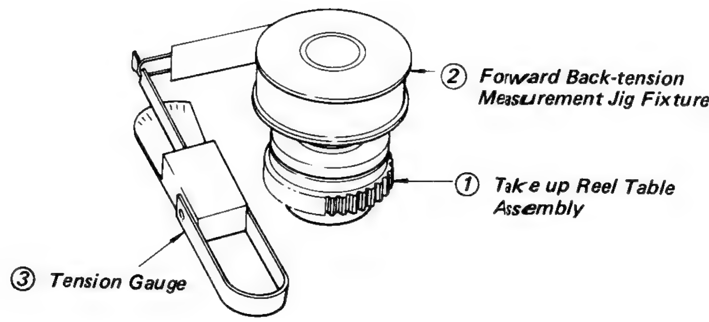


Fig. 5-60 Take up Brake Torque Measurement

18-2. Adjusting and Replacing the Take up Brake Lever (Fig. 5-61)

If the measured take up brake torque is lower than the value specified above, proceed as follows:

1. Wipe the surface of the take up reel table.
2. Replace the take up brake lever by following Item (3) below.

Replacement

1. Remove the cassette compartment assembly.
2. Remove the take up reel table by following Section 5-3-10.
3. Unhook the pause spring and pull the pause lever ① out of the reel chassis for removal (see Fig. 5-40).
4. Unhook the brake spring ② from the take up brake lever ①.
5. Pull the take up brake lever ① straight up for removal from the reel chassis.
6. To reassemble, reverse Steps 1 through 5.

   CAUTIONS: 1. In mounting the take up brake lever ①, fit this in position with the take up brake shift lever ③.

   2. Care should be taken not to touch the take up brake felt by hand, nor to apply any oil to it.
7. After replacement, proceed with checking as directed above.

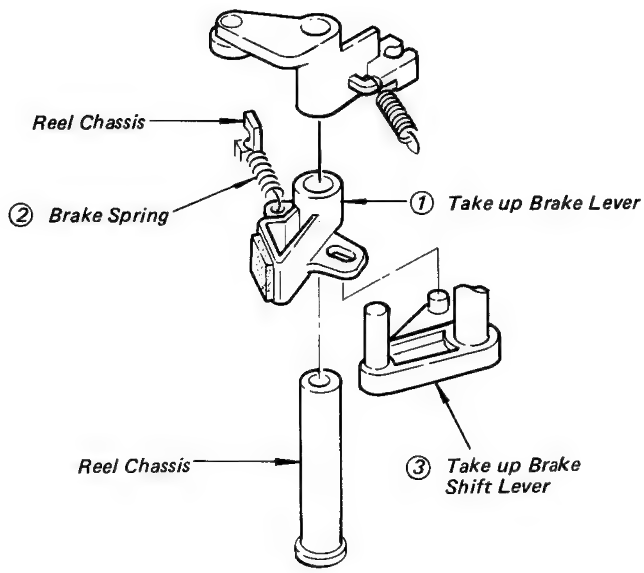


Fig. 5-61 Take up Brake Lever Removal

19. Checking and Adjusting the Fast-Forward Brake Torque and Replacing the Associated Component

The Fast-Forward brake torque refers to the brake torque of the supply reel table in the Fast-Forward or cue mode of operation. In the Fast-Forward mode of operation, improper Fast-Forward brake torque can cause the tape to have excessive slack or can result in too long winding time. To prevent such a failure, proceed as follows:

19-1. Checking (Fig. 5-62)

1. Remove the cassette compartment assembly.
2. Turn the supply reel table ① several times clockwise by hand for aging.
3. Install the forward back-tension measurement jig fixture ② in position on the supply reel table ①.
4. Set the VCR in the Fast-Forward or cue mode of operation.
5. Read the tension gauge ③, while stretching the tape at an approximate speed of 18 mm/sec by the tension gauge ③. The Fast-Forward brake torque should be in the range of 10 to 20 g.cm.

   NOTE: The Fast-Forward brake torque is denoted by T.

   $T = Rt \times Rg$

   Rt: tape radius (cm)

   Rg: read of the tension gauge (g)

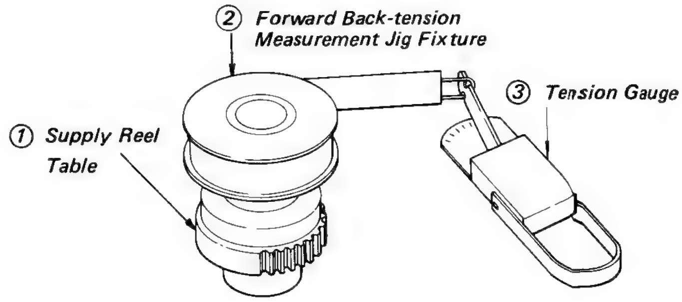


Fig. 5-62 Fast-Forward Brake Torque Measurement

19-2. Adjusting

If the measured Fast-Forward brake torque is out of the range specified above, proceed as follows:

1. If it is too weak, adjust the Fast-Forward brake spring by shortening within four turns.
2. If it is too large, adjust the Fast-Forward brake spring by elongating a little.
   CAUTION: Care should be taken not to elongate it too much, nor to deform it.
3. If proper torque cannot be obtained yet, then replace the Fast-Forward brake lever by following Item 19-3 below.

19-3. Replacing the Fast-Forward Brake Lever (Fig. 5-63)

1. Remove the cassette compartment assembly.
2. Unhook the U-shaped hook of the band brake assembly ⑨ from the tension lever by following Section 5-3-28.
3. Set the loading disk in the unloading end state.
4. Remove the two screws holding the cassette detect bracket ④.
5. Take out the cassette detect bracket ④ together with the cassette detect slider ⑤ held by the cassette detect spring ⑥.
   NOTE: In removal, leave the band brake assembly ⑨ held on the cassette detect bracket ④ by screws.
   CAUTION: In handling the band brake assembly ⑨, care should be observed not to scratch and bend it.
6. Unhook the Fast-Forward brake spring ⑧ from the Fast-Forward brake lever ⑦.
7. Lift the Fast-Forward brake lever ⑦ straight up for removal.
8. To reassemble, reverse Steps 1 through 7.
   CAUTIONS: 1. Care should be taken in tightening the screws ⑩, or too firm tightening could break down the female threads of the opposite plastic components parts.
   2. Do not touch the Fast-Forward brake felt by hand, nor apply any oil to it.
9. After replacement, proceed with checking as directed above.

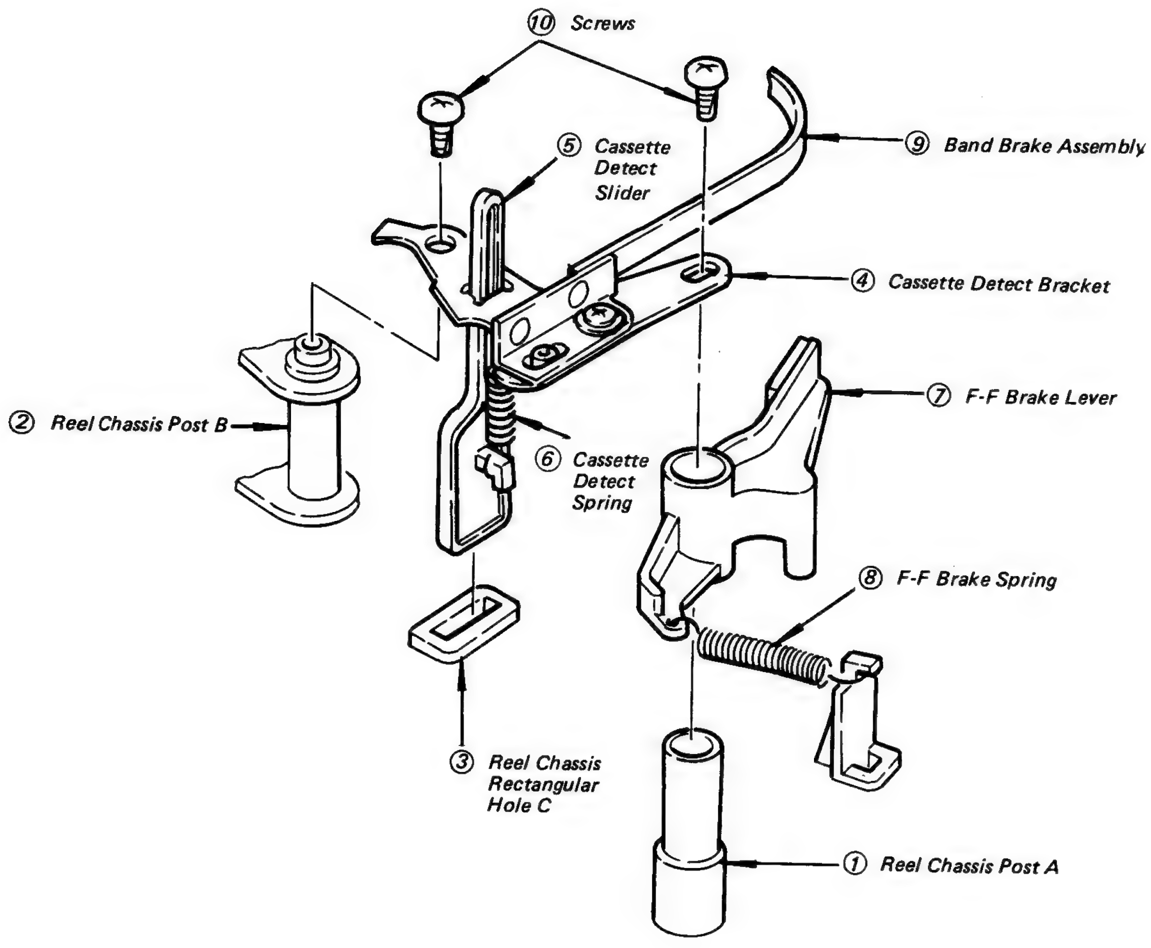


Fig. 5-63 Fast-Forward Brake Lever Remvoal

20. Checking and Adjusting the Rewind Brake Torque and Replacing the Associated Component

The rewind brake torque refers to the brake torque of the take up reel table in the rewinding or review mode of operation. Improper rewind brake torque can not rewind the tape or to stop on the way of rewinding. It, also, can result in improper winding torque in the recording or playback mode of poeration. This leads to abnormal tape running and to wrong tape counter poeration. To prevent such failures, proceed as follows:

20-1. Checking (Fig. 5-64)

1. Remove the cassette compartment assembly.
2. Install the forward back-tension measurement jig fixture ② in position on the take up reel table assembly ① .
3. Set the VCR in the rewinding or review mode of operation.
4. Read the tension gauge ③ , while stretching the tape at an approximate speed of 18 mm/sec by the tension gauge ③ . The rewind brake torque should be weaker than 18 g.cm.
   NOTE: The rewind brake torque is denoted by T.
   $T = Rt \times Rg$
   Rt: tape radius (cm)
   Rg: read of the tension gauge (g)

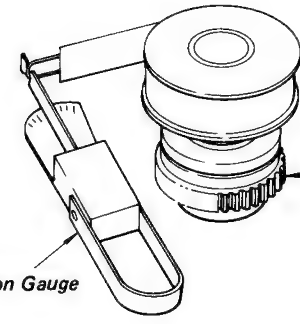


Fig. 5-64 Rewind Brake Torque Measurement

20-2. Adjusting (Fig. 5-65)

If the measured rewind brake torque is larger than the value specified above, proceed as follows:

1. Check to insure that the two counter belts are not slipped off the intermediate pulley and counter pulley and are not touching any wire and the like. If so, correct them.
2. Revolve the take up reel table assembly ① by hand to check that the counter operates normally. If not, replace the counter (refer to Section 5-3-1).
3. Remove the counter belts.
4. Set up the VCR in the rewinding or review mode of operation.
5. Remove the take up reel table assembly ① and to check that this can be revolved freely. If not, replace it by following Item 20-3 below. Also, refer to Section 5-3-10, the "Take up reel table assembly replacement".
6. If the counter belts ② and ④ are elongated or abraded too much, then replace them.

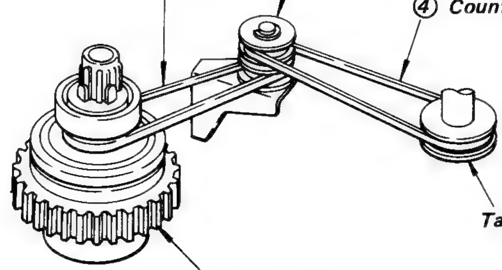


Fig. 5-65 Counter Belt Removal

20-3. Replacing the Counter Belt (Fig. 5-65)

1. Remove the cassette compartment assembly.
2. Replace the two counter belts ② and ④ .
   CAUTIONS:
   1. In installation, care should be exercised not to scratch them by sharp metal edges or points, not to apply any oil to them.
   2. Make certain that they are not touching any wire and the like.
   3. Check for twisting.
3. After completion of replacement, check to insure that the counter operates normally.
4. Proceed with checking as directed in Item 20-1 above.

21. Checking the Pause Brake Torque

Improper pause solenoid adjustment results in too weak pause brake torque to fully stop the tape or to allow the pause solenoid to extract the plunger in the pause mode of operation. To prevent such a failure, proceed as follows:

21-1. Checking (Fig. 5-66)

1. Remove the cassette compartment assembly.
2. Press the record safety bracket to turn the record safety switch off.
3. Press the tape slack detect lever by hand to restrain its motion.
4. Set the VCR in the recording mode of operation.
5. In turn, set it into the pause state.
   NOTE: The VCR should not be set from the playback mode to the pause state, or still state, as this does not allow the pause solenoid to be energized, but the capstan is stopped only.
6. Install the forward back-tension measurement jig fixture ② in position on the take up reel table assembly ①.
7. Read the tension gauge ③ when the tape is moved as stretched by it at approximately 20 mm/sec. The pause brake torque should be higher than 100 g.cm.
   NOTE: The pause brake torque is denoted by T.
   $T = Rt \times Rg$
   Rt: tape radius (cm)
   Rg: read of the tension gauge (g)

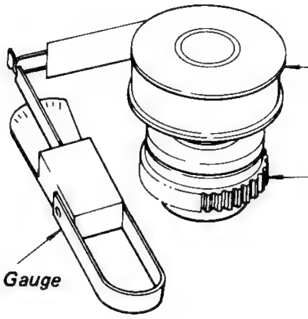


Fig. 5-66 Pause Brake Torque Measurement

21-2. Correction

If the measured pause brake torque is less than the value specified above, adjust as follows.

1. Adjust the pause solenoid for the stroke by following Item 21-3.
2. If the pause solenoid is defective in the plunger extraction, then replace the pause solenoid by following Item 21-4.

21-3. Adjusting the Pause Solenoid Stroke (Fig. 5-67)

1. Remove the cassette compartment assembly.
2. Loosen the two screws ④ holding the pause solenoid ③.
3. Put a bladed screwdriver into the rectangular hole of the solenoid bracket ⑤ and move the pause solenoid ③ in the direction B (↓).
4. Turn the VCR from the recording mode to the pause state.
5. Keeping the pause solenoid energized, gradually move the pause solenoid ③ body in the direction A (↑) until the pause tyre ② is around 0.5 mm farther than pressed to the take up reel table assembly ⑥.
6. Tighten the screws ④.
7. Proceed with checking as directed in Item 21-1.
8. Install the cassette compartment assembly.
9. Put a cassette into the cassette compartment and check to insure that the tape can be fully stopped when the VCR is set into the pause state.

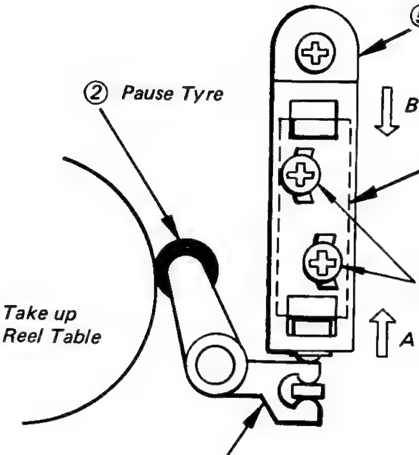


Fig. 5-67 Pause Solenoid Stroke Adjustment

21-4. Replacing the Pause Solenoid (Fig. 5-68)

1. Remove the cassette compartment assembly.
2. Remove the pause lever.
3. Remove the screw ⑥ holding the solenoid bracket ② .
4. Slide the solenoid bracket ② in the direction B (←) and lift it straight up for removal.
5. Cut out the harness binder to make the wires free.
6. Remove the two screws ⑦ and two spring washers ⑧ holding the pause solenoid ⑤ .
7. Unplug the connector of the pause solenoid ⑤ .
8. Take out the pause solenoid ⑤ for removal.
9. To reassemble, reverse Steps 1 through 8.
   NOTES: 1. In installing the solenoid bracket ② , keep the record safety lever ④ fitted with the U-shaped part of the record safety bracket ⑨ when moving the solenoid bracket ② in the direction A, as shown.
   2. Bind the record safety switch ③ lead wires together with the pause solenoid ⑤ lead wires.
10. Proceed with checking as directed in Item 21-1 above.

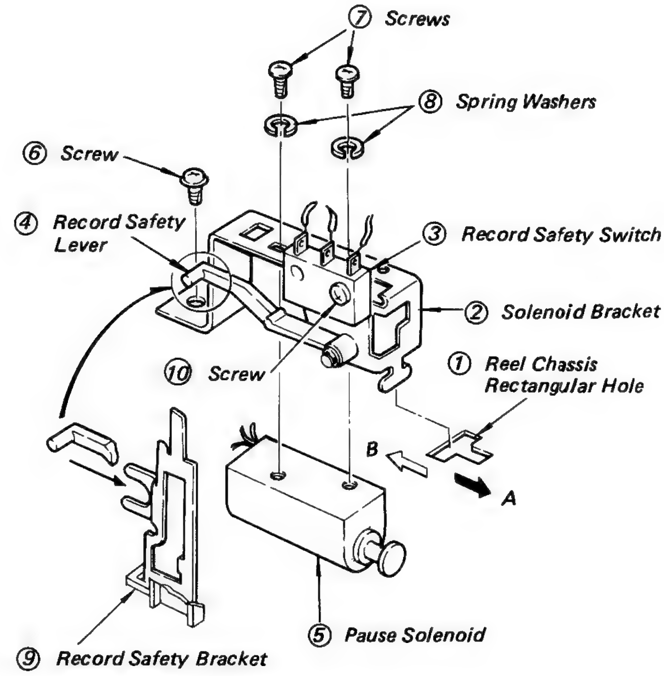


Fig. 5-68 Pause Solenoid Removal

22. Checking, Adjusting and Replacing the Play Solenoid

Wrong play solenoid position, or too distant plunger stroke, results in that the play solenoid cannot function properly in attraction. Too short plunger stroke, on the other hand, results in abnormal tape running, no revolution of the take up reel table, or scratching the tape. To prevent such failures, check as follows:

22-1. Checking (see Figs. 5-69, 5-70)

1. Remove the upper cover and cassette compartment.
2. Turn power on.
3. Set the VTR in the playback mode of operation for loading without a cassette, with the slack lever is fixed with tape.
4. Make certain that the play idler is pressed to the take up reel table assembly and the take up reel table has a required torque, 60 to 160 g.cm (refer to Section Item 5-3-12).
5. Also, make certain that there is clearance 1 mm between the surface of the F-F brake lever ① and supply reel table ② (see Fig. 5-69).
6. Further, make certain that the clearance between the shift lever ① of the tension servo assembly and the roller of the tension lever assembly ② is around 1 mm (see Fig. 5-70).

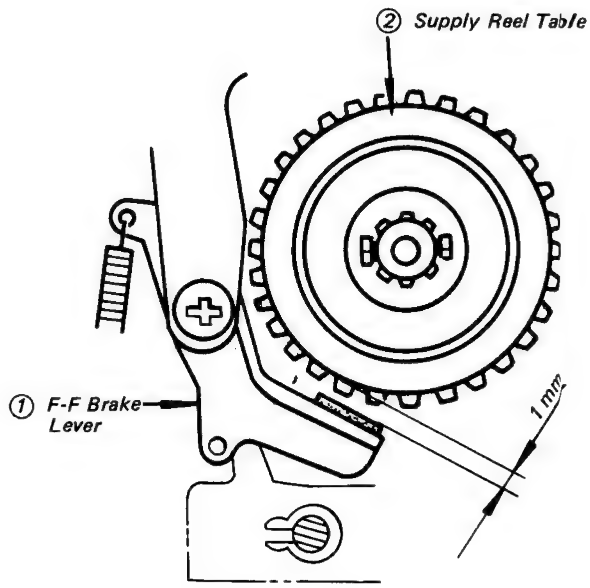


Fig. 5-69 Clearance Required Between End of F-F Brake Lever and Supply Reel Brake

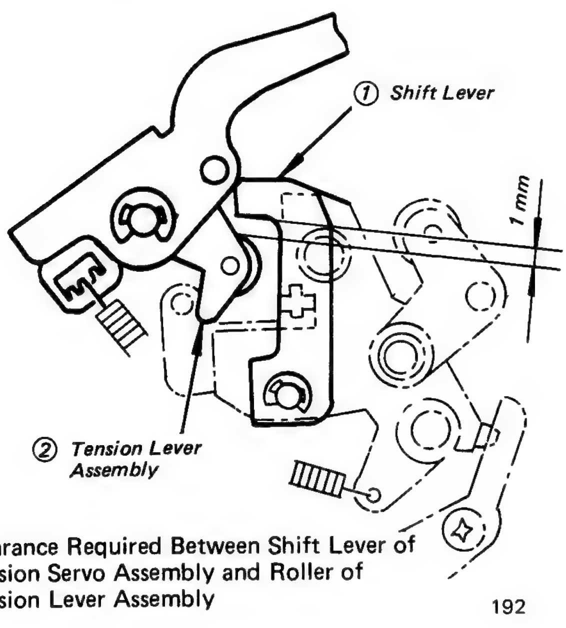


Fig. 5-70 Clearance Required Between Shift Lever of Tension Servo Assembly and Roller of Tension Lever Assembly

22-2. Adjusting (see Figs. 5-71, 5-72)

If the play solenoid is not aligned appropriately, adjust as follows:

1. Turn power off.
2. Remove the Logic Circuit board.
3. Loosen the two screws ③ holding the play solenoid ①
4. Insert a bladed screwdriver into the reel drive chassis alignment cut-out hole ② and slide the play solenoid ① leftward (←).
5. Turn power on.
6. Set the VTR in the playback mode of operation to energize the play solenoid ①, with the slack lever fixed with tape.
7. Keeping the play solenoid ① is energized, move the play solenoid ① rightward (→) so that the play idler ③ can be pressed to the take up reel table assembly ④ and then the outside of the lower boss of the play lever assembly ⑤ can be cleared around 1 mm off the end surface of the play sublever ⑥.
8. Tighten the two screws.
9. After adjustment, check the play solenoid for position.

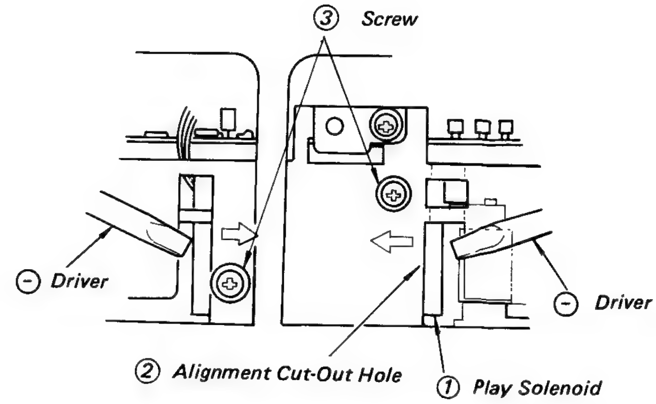


Fig. 5-71 Play Solenoid Sliding

22-3. Replacement (Fig. 5-73)

1. Remove the cassette compartment assembly.
2. Remove the Logic Control board.
3. Unplug the connectors from the solenoid drive board ①.
4. Remove the solenoid drive board ①.
5. Remove the solenoid drive board holder ②
6. Remove the two screws holding the play solenoid ③.
7. Lift the play solenoid ③ straight up for removal, leaving the plunger core.
8. Take out the plunger core.
9. Replace the play solenoid ③ by reversing Steps 1 through 8.
10. After replacement, adjust the play solenoid position by following the "Adjustment" procedures given above.

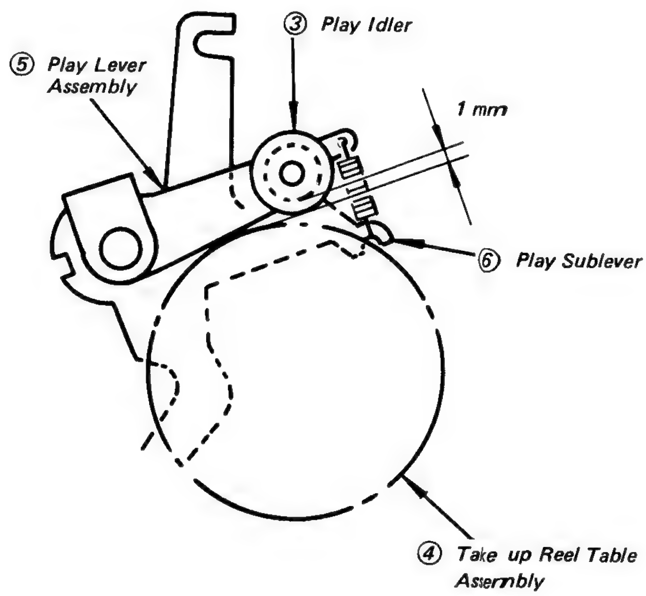


Fig. 5-72 Clearance Required Between Outside of Lower Boss of Play Lever Assembly and End Surface of Play Sublever

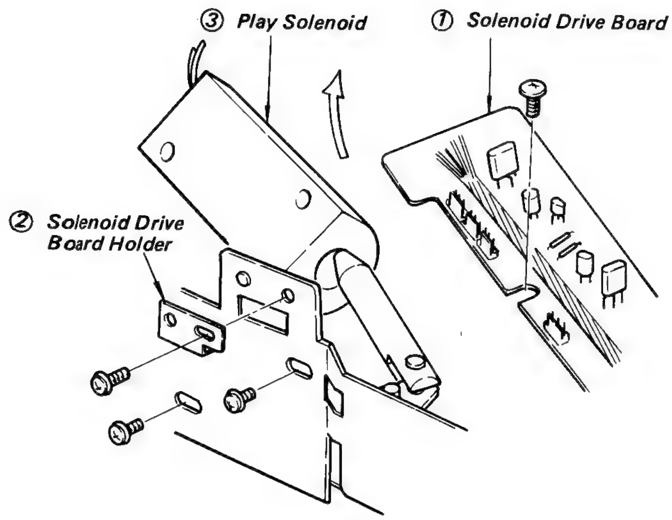


Fig. 5-73 Solenoid Drive Board and It's Holder Removal

23. Checking, Adjusting and Replacing the Eject Solenoid

Wrong position of the eject solenoid results in no winding of tape by the take up reel in unloading, no unloading, or no raising the cassette compartment. To prevent such a failure, check as follows:

23-1. Checking

1. Remove the upper cover.
2. Insert a cassette in position.
3. Set the VTR in the loading end state.
4. Depress the EJECT button. Then, make certain that the loading disk starts smooth turning, the tape is normally wound by the take up reel table, and the cassette compartment assembly is securely raised up at the unloading end.

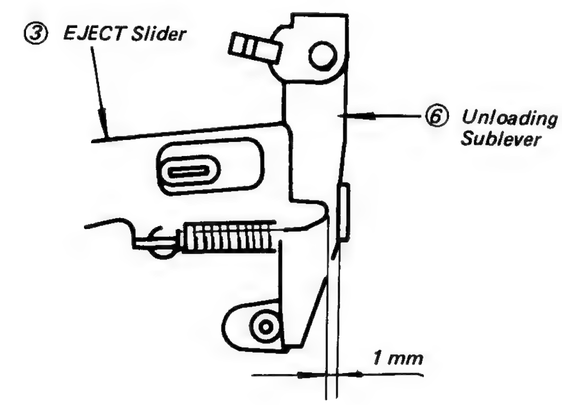


Fig. 5-75 Clearance Between Eject Slide and Unloading Sublever

23-2. Adjusting (see Fig. 5-74, 5-75)

If the eject solenoid is not in appropriate position, adjust the eject solenoid bracket as follows:

1. Set the VTR in the unloading state.
2. Disengage the gear of the loading drive assembly from the gear of the loading disk.
3. Hold the cassette detect switch in the ON state.
4. Loosen the screws holding eject solenoid bracket ①. (open the Video Board.)
5. Slide the eject solenoid bracket ① in the B direction (→).
6. Set the VTR in the eject mode of operation to energize the eject solenoid ② to extract the plunger core.
7. Insert a braded screwdriver into the reel drive chassis adjustment hole and move the eject solenoid bracket ① in the A direction (←). The eject slide ③ , then, actuates the unlock lever ④ to move the unlock slider ⑤ downward (↓).
8. Tighten the two screws where the clearance between the spring suspending bent portion of the unlock slider ⑤ and the slide guide on the reel drive base is 5.5 mm.

   NOTE: The Solenoid will be deenergized in approximately 20 sec after the EJECT button was depressed.
9. After adjustment, make certain that when the eject solenoid ② is energized to attract the plunger core, the eject slide ③ is cleared around 1 mm off the unloading sublever ⑥ (see Fig. 5-74, 5-75).
10. Reset the VTR to the original condition.
11. Make certain that the loading and unloading operations are normal without the tape cassette first and with it inserted.

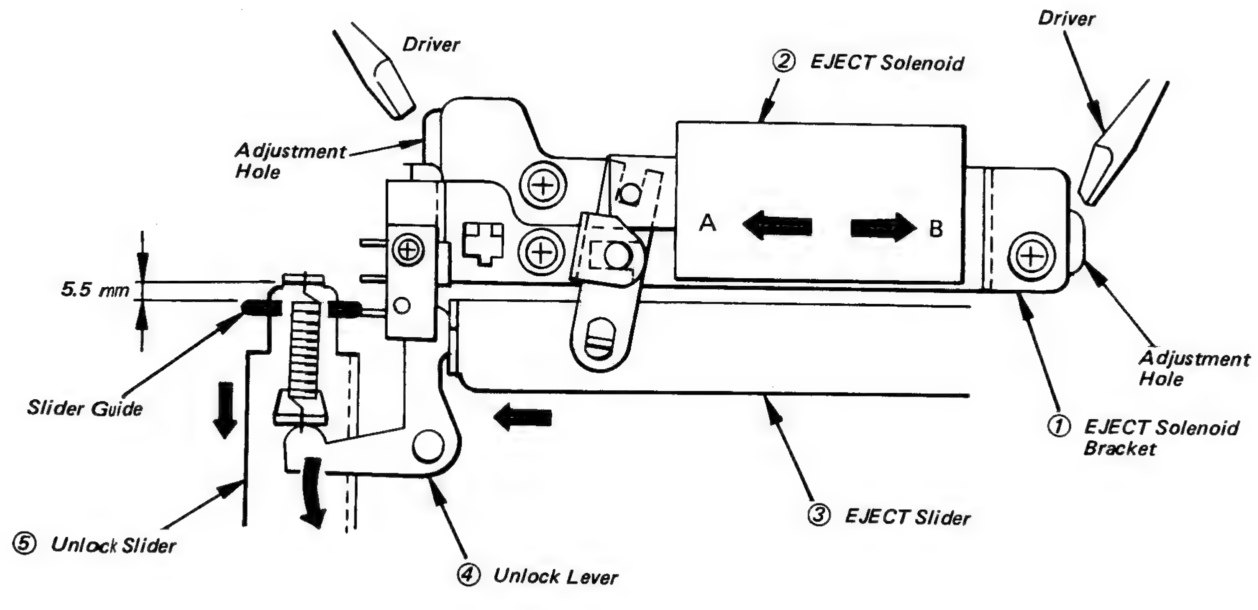


Fig. 5-74 Eject Solenoid Adjustment

23-3. Replacing (see Fig. 5-76).

1. Unplug the eject solenoid ① connector from the solenoid drive board.
2. Remove the two screws holding the eject solenoid bracket ② .
3. Also, remove the two screws holding the eject solenoid ① .
4. Take out the eject solenoid ① for removal.
5. Replace the eject solenoid ① by reversing Steps 1 through 4.
6. After replacement, check:
   a. Eject solenoid position.
   b. Eject detect switch position (refer to Section 5-3-24).

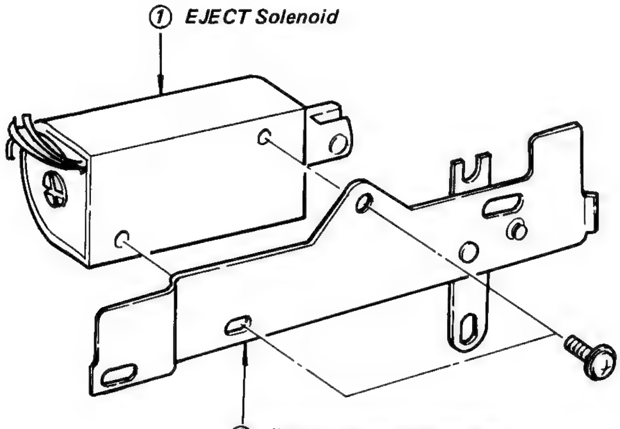


Fig. 5-76 Eject Solenoid Replacement

24. Checking, Adjusting, and Replacing the Eject Detect Switch

Wrong eject detect switch position results in no unloading or no winding of tape. To prevent such a failure, check as follows:

24-1. Checking

Make certain that the eject detect switch is turned on around 0.5 mm before the stroke end of the eject slide bar as the plunger core is pressed into the eject solenoid.

24-2. Adjusting (see Fig. 5-77)

To adjust the eject detect switch position, proceed as follows:

1. Set the loading disk in the loading end state to bring the loading drive assembly away from the disk.
2. Loosen the screw ① .
3. Slide the eject detect switch ② , or the eject detect switch bracket ③ , rightward (→) using a braded screwdriver.
4. Set the VTR in the eject mode of operation to energize the eject solenoid ④ to attract the plunger core.
5. Using the braded screwdriver, move the eject detect switch ② to a position 0.5 mm far away from the point where the eject detect switch ② can be turned on by the eject slide ⑤ , or a click is heard and the loading motor revolves.
6. Tighten the screw ① .
7. After adjustment, make certain that the eject detect switch ② is securely turned on in unloading.

24-3. Replacing (see Fig. 5-78)

1. Remove the screw ② holding the eject detect switch ① .
2. Unsolder the lead wires from the eject detect switch ① using a soldering iron.
3. Replace the eject detect switch ① by reversing Steps 1 and 2.
4. After replacement, adjust the eject detect switch position.

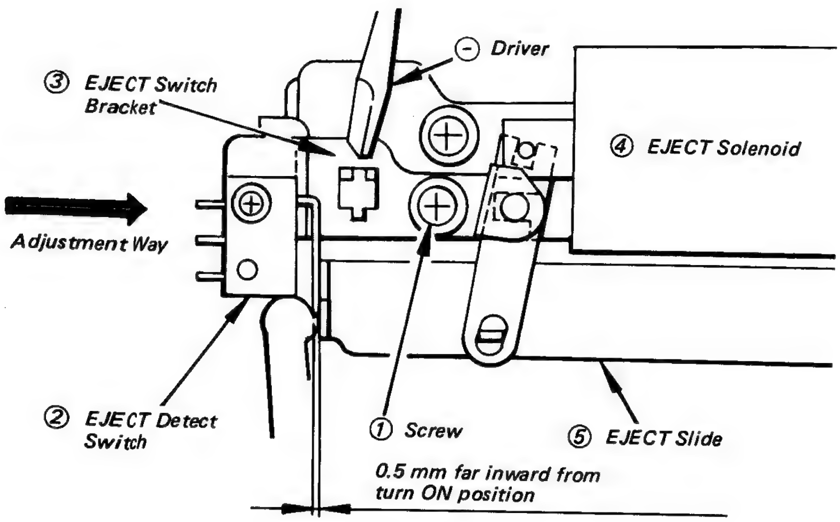


Fig. 5-77 Eject Detect Switch Adjustment

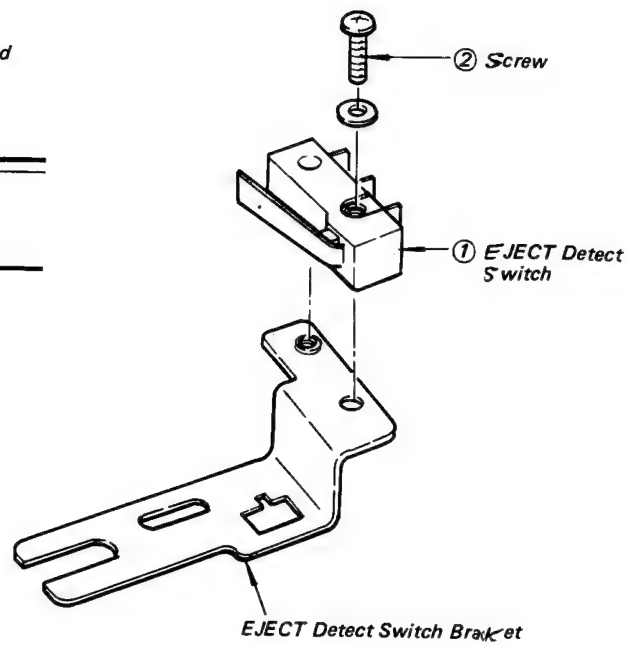


Fig. 5-78.

25. Checking, Adjusting, and Replacing the Cue/Review Solenoid

Improper adjustment of the cue/review solenoid can cause the planetary gear unit assembly to produce anomalous noise and to fail in the normal speed reduction. The result is that good picture cannot be obtained in the picture search mode of operation. To prevent such a failure, proceed as follows:

25-1. Checking

1. Place the cassette into the cassette compartment.
2. Press the POWER switch ON.
3. Press the CUE (or REVIEW) button for setting up the VTR in the picture search mode of operation.
4. Make certain that chattering is not heard from the inside of the reel chassis.
5. Set the VTR in the Fast-Forward (or rewinding) mode and in the cue (or review) mode one after the other several times, and make certain that the latter tape speed is reduced to about one-third of the former tape speed.

25-2. Correction

If the cue (or review) operation is defective, proceed as follows:

1. Adjust the cue/review solenoid for stroke.
2. If the cue/review solenoid fails to normally extract the plunger, then replace the cue/review solenoid.
3. If the planetary gear unit assembly cannot function normally, replace it.

25-3. Adjusting stroke of the Cue/Review Solenoid (Figs. 5-70, 5-80)

1. Open the video Circuit board.
2. Slip the reel belt ⑨ off for removal.
3. Slip the reel belt ⑩ off for removal from the Fast-Forward clutch assembly only, but remain the reel belt ⑩ held on the output pulley ⑧.
4. Remove the two screws ⑤ holding the planetary gear unit assembly ①.
5. Loosen the two screws ⑫ holding the cue/review solenoid ④.
6. Slide the cue/review solenoid ④ in the direction B (→).
7. Set the VTR in the cue (or review) mode of operation for energizing the cue/solenoid ④ to extract the plunger.
8. Insert a bladed screwdriver in the rectangular hole, and gradually move the solenoid in the direction A (←) until the internal gear ⑪ is positioned as shown in Fig. 5-80.
9. Tighten the screws ⑫.
10. Reassemble by reversing Steps 1 through 7.

    CAUTIONS:
    1. The planetary gear unit assembly ① should be fitted with the positioning notches before tightening the screws ⑤.
    2. Do not touch the belt by bear hand, nor apply any oil to it.
    3. Correct the belt for twist before installing.
11. Proceed with checking by following Item 25-1 above.

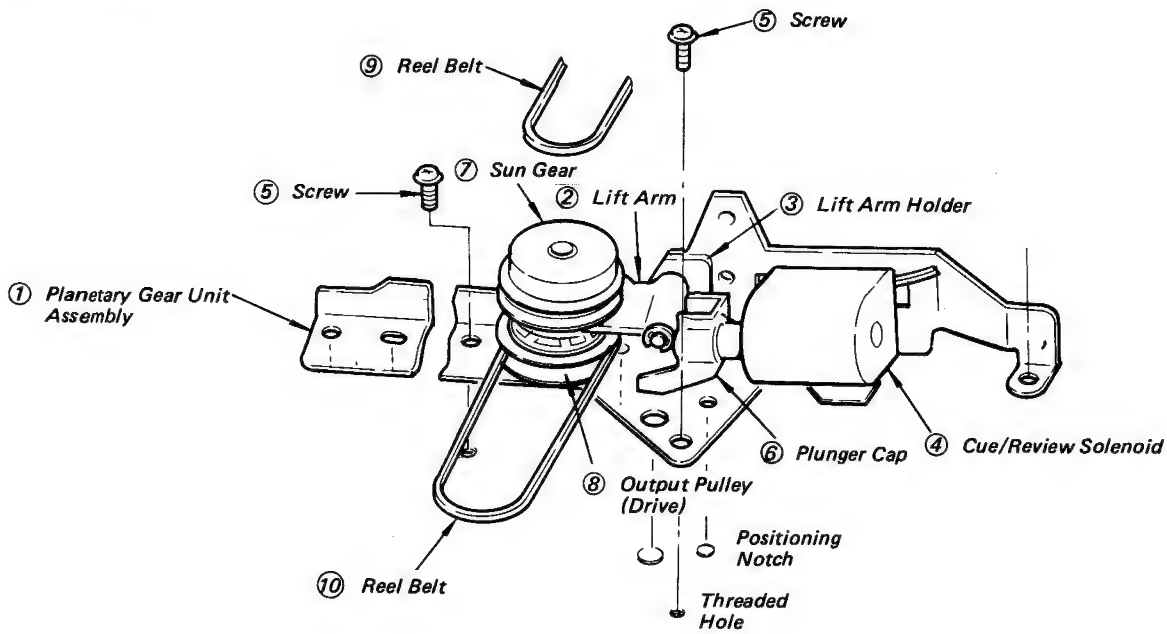


Fig. 5-79 Planetary Gear Unit Assembly Removal

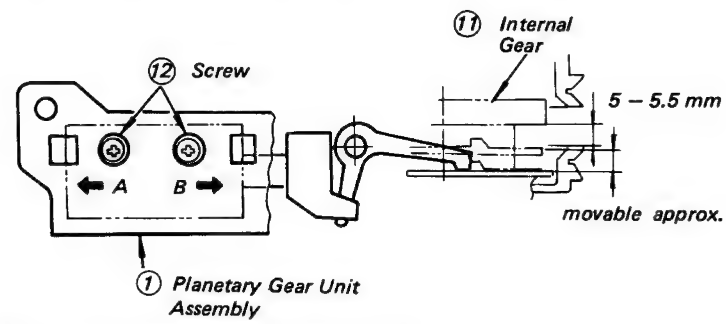


Fig. 5-80 Cue/Review Solenoid Adjustment

25-4. Replacing the Cue/Review Solenoid (Fig. 5-79, 5-81, 5-82, 5-83)

1. Follow Item 25-3 above, Steps 1 through 4.
2. Remove the screw ⑬ holding the lift arm holder ③.
3. Take out the lift arm holder ③ for removal.
4. Remove the two screws ⑫ holding the cue/review solenoid ④ body.
5. Replace the cue/review solenoid ④ body.
6. Push the spring pin ⑮ is the direction A (↓) into the plunger ⑭ of the cue/review solenoid using a long-nose pliers (see Fig. 5-82).
7. Pull the plunger ⑭ in the direction B (←) out of the plunger cap ⑥ for removal.
8. To reinstall, insert the plunger ⑭ into the plunger cap ⑥ by pushing in the direction B (→).
9. Then, push the spling pin ⑮ to the center of the plunger cap ⑥ by pushing in the direction A (↓) (see Fig. 5-83).
10. Put the cue/review solenoid ④ in position together with the plunger ⑭.
11. Then, tighten the two screws ⑫ to temporarily hold them to the planetary gear unit assembly ①.
12. Tighten the screw ⑬ to hold the lift arm holder ③ with the lift arm fitted with the plunger cap ⑥.
13. Adjust the cue/review solenoid for stroke as directed in Item 25-3 above.
14. Reinstall the planetary gear unit assembly to the reel chassis by reversing Step 1.
    CAUTIONS: 1. Care should be taken not to scratch the reel belts, nor apply any oil to it.
    2. The reel belts should not be twisted.
15. Proceed with checking by following Item 25-1 above.

25-5. Replacing the Planetary Gear Unit Assembly (Fig. 5-79).

1. Following the Item 25-4, Steps 1 through 3.
2. Remove the two screws ⑫ holding the planetary gear unit assembly ①.
3. Replace the planetary gear unit assembly ①.
4. Place the reel belt ⑩ onto the output pulley ⑧ in advance.
5. To reasemble, reverse Steps 1 through 2.
6. Proceed with checking by following Item 25-1 above.

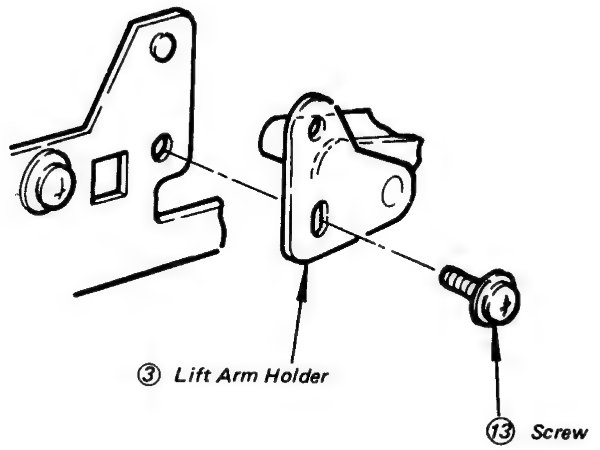


Fig. 5-81 Disconnection Lift Arm Holder Removal

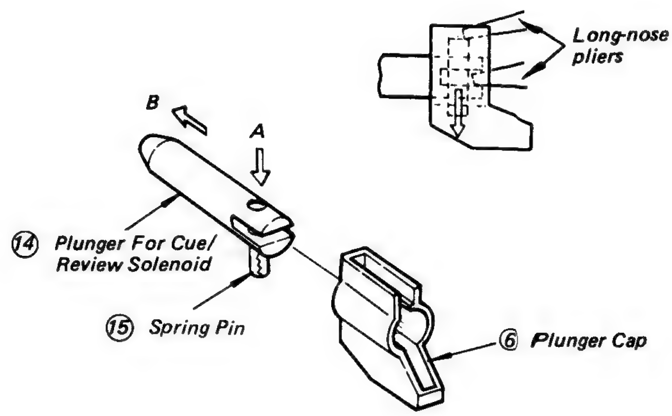


Fig. 5-82 Plunger Removal

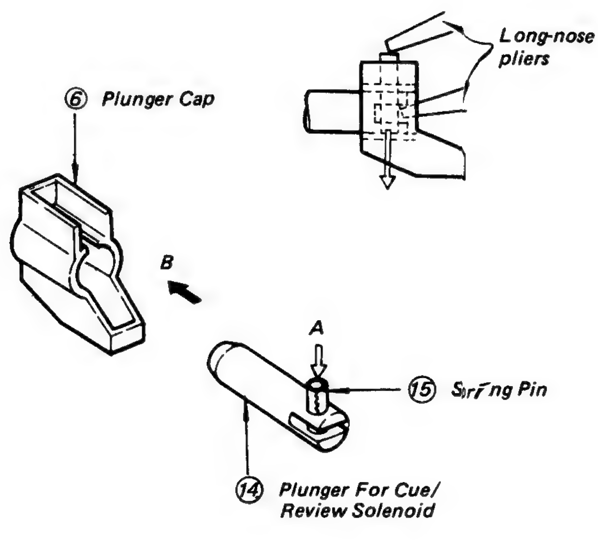


Fig. 5-83 Plunger Installation

26. Checking and Replacing the Record Safety Switch

Improper adjustment of the record safety switch can cause recording on the cassette tape even when the record safety tab is broken out.

26-1. Checking (Fig. 5-84)

1. Remove the cassette compartment assembly.
2. Check the record safety switch as follows:
   a. Press the record safety bracket ① to make certain that the record safety switch ② is turned on or off until its height, H, becomes 1 mm.
   b. Then, release the record safety plate ① to make certain that the record safety switch ② returns to the original state.
3. Repeat the checking several times to insure that the record safety switch ② can be normally actuated.

26-2. Correction (Fig. 5-85)

1. Make certain that the connection part of the record safety lever ③ is fitted correctly with the U-shaped part of the record safety bracket ①. If not, adjust for correct coupling.
2. If the record safety switch ② is not actuated in the specified timing, adjust by bending the actuator of the record safety switch a little.
3. In case that the record safety switch ② does not work properly, then replace it.

26-3. Replacing the Record Safety Switch (Fig. 5-68)

1. Follow Section 5-3-21, the "Checking the Pause Brake Torque", Item (4), the "Replacing the Pause Solenoid" procedures, Steps 1 through 4.
2. Unsolder the lead wires of the record safety switch ③. (Fig. 5-68)
3. Remove the screws ⑩ holding the record safety switch ③.
4. Take out the record safety switch ③ for removal.
5. To reassemble, reverse Steps 1 through 4.

CAUTION: Arrange the soldered lead wires by binding so as not to touch the counter belt.

27. Checking, Adjusting and Replacing the Pinch Lock Assembly

In the recording, audio dubbing, or playback mode of operation, bad adjustment of the pinch lock assembly can result in that:

a. The tape speed is unstable.
b. The lead switch is adversely turned on for auto-stopping even in the normal tape running.
c. Even when the tape have some slack, the lead switch cannot be turned on, resulting in tangling of the tape onto the capstan or pinch roller.

To prevent such failures, proceed as follows:

27-1. Checking (Fig. 5-85)

1. Remove the upper cover.
2. Set up the loading disk in the loading end state without the cassette.
3. Holding the slack lever, press the PLAY button to set the VTR in the playback mode of operation.
4. Make certain that the clearance A between the pinch lock bracket ⑤ and lock actuator is 0.3 to 0.7 mm (see Fig. 5-85).
5. Make certain that the lead switch ⑫ is turned on for auto-stopping when the slack lever is gradually moved to position the slack lever pole ⑨ at a distance of approximately 1 mm from the slack lever stopper on the loading disk (see Fig. 5-85).

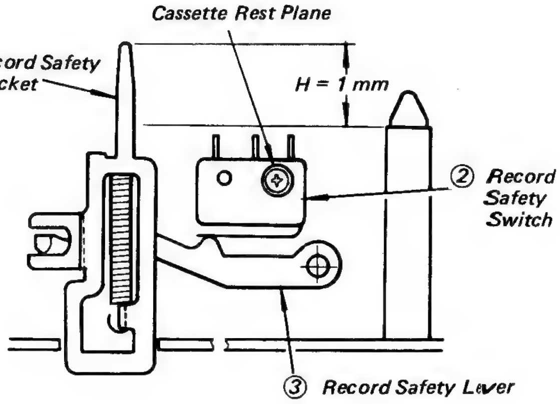


Fig. 5-84 Record Safety Switch Checking

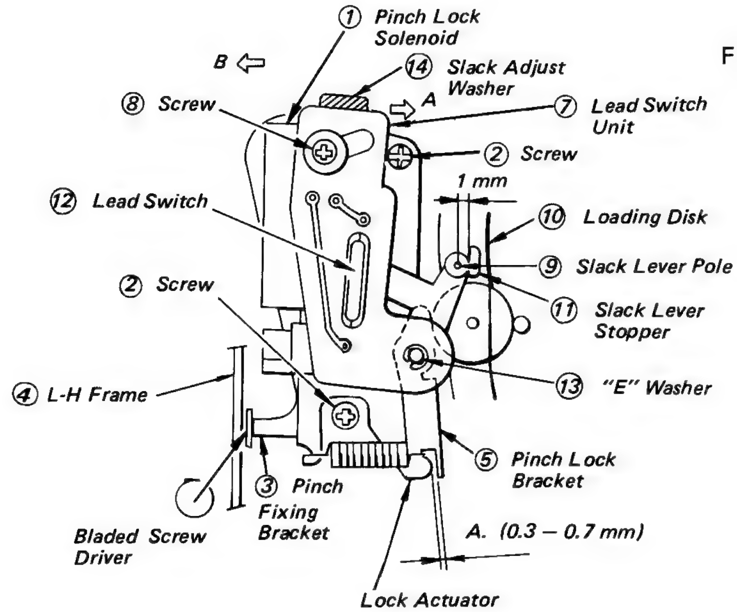


Fig. 5-85 Pinch Lock Assembly Checking, Pinch Roller Pressure Adjustment, and Lead Switch Unit Positioning

27-2. Adjusting Pressure of the Pinch Roller (Fig. 5-85)

1. Set in the loading end state.
2. Holding the slack lever, press the PLAY button to energize the pinch lock solenoid ① for plunger extraction.
3. Loosen the two screws ② holding the pinch lock assembly.
4. Putting a bladed screwdriver into the space between the bent tip of the pinch fixing bracket ③ and the left-hand frame ④, adjust the pinch fixing bracket ③ until the clearance A between the pinch lock bracket ⑤ and lock actuator ⑥ is in the range of 0.3 to 0.7 mm.
5. Tighten the two screw ②.
6. Playback and stop the VTR repeatedly several times to check for the clearance A.

27-3. Lead Switch Unit Positioning (Fig. 5-85)

1. Set the loading disk in the loading end state.
2. Loosen the screw ⑧ holding the lead switch unit ⑦.
3. Move the lead switch unit ⑦ fully in the direction A (→)
4. Press the PLAY button to energize the pinch lock solenoid ① for plunger extraction.
5. Insert a spacer of 1 mm thick into the space between the slack lever pole ⑨ and slack lever stopper ⑪ of the loading disk ⑩.
6. Gradually move the lead switch unit ⑦ in the direction B (←) until the lead switch ⑫ is turned on.
7. Tighten the screw ⑧.

27-4. Adjusting Height of the Lead Switch (Fig. 5-85)

If the lead switch cannot be turned on even by carrying out the above "Lead Switch Unit Positioning" procedures, then adjust for the height as follows:

1. Turn power off.
2. Remove the screw ⑧ and "E" washer ⑬ holding the lead switch unit ⑦.
3. There is a slack adjust washer ⑭ between the lead switch unit and slack fixing bracket. If it is of 1 mm thick, replace by 0.5 mm one. If it is 0.5 mm one, remove it.
4. There is mounted a polyethylene slider on the pinch shaft.
5. If it is underneath the lead switch unit ⑦, replace it onto the lead switch unit ⑦.
6. Place the "E" washer ⑬ in position on the lead switch unit ⑦.
7. Temporarily tighten the screw ⑧.
8. Turn power on.
9. Gradually move the lead switch unit ⑦ in the direction B (←) until the lead switch is turned on.
10. Firmly tighten the screw ⑧.

    CAUTION: When the slack lever is moving, make certain that this is free of touching the lead switch.
11. Proceed with checking as directed in Item 27-1 above.

27-5. Replacing the Pinch Lock Solenoid (Fig. 5-86)

Removal

1. Remove the two screws holding the pinch lock assembly.
2. Pull the pinch lock assembly out of the left-hand frame for removal.
3. Unsolder the three lead wires on the pinch lock solenoid ② using a soldering iron.
4. Remove the "E" washer ③ and screw ④ holding the lead switch unit ①.
5. Take out the lead switch unit ① for removal.
6. Remove the screw ⑤ holding the slack fixing bracket ⑥.
7. Take out the slack fixing bracket ⑥ for removal.
8. Unhook the slack lever spring ⑦ from the slack lever.
9. Also, unhook the pinch release spring ⑧ from the pinch fixing bracket ⑨.
10. Remove the two screws ⑩ holding the pinch lock solenoid ②.
11. Take out the pinch lock solenoid ② for removal.
12. In turn, pull the spring pin ⑪ from the plunger core of the pinch lock solenoid ②.
13. Pull the pinch cap ⑫ for removal from the plunger core.

Installation

1. To reassemble the pinch lock solenoid ②, including the plunger core, reverse Steps 1 through ⑬ above.
2. After completion of reassembly, carry out adjustment as directed in the "Pinch Lock Assembly Adjustment" section.

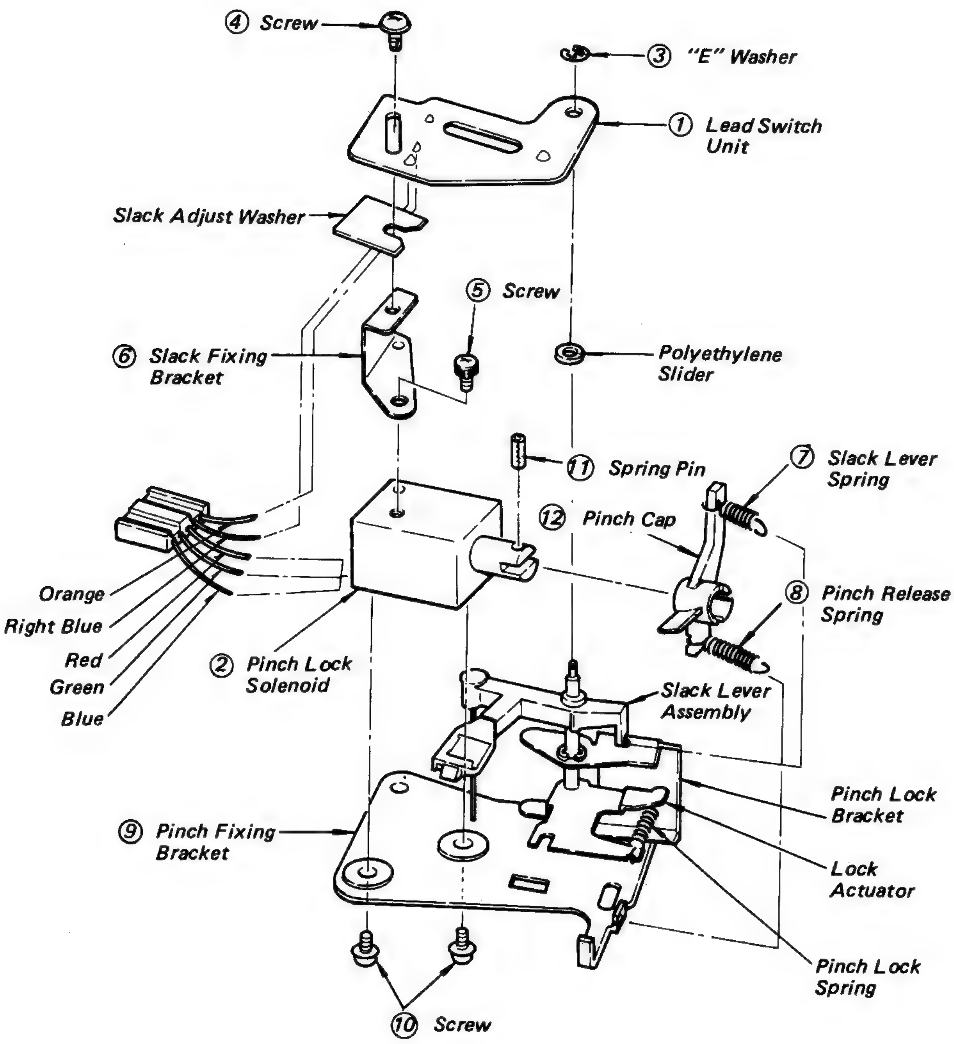


Fig. 5-86 Pinch Lock Solenoid Removal

28. Checking, Adjusting and Replacing the Tension Servomechanism

28-1. Checking and Adjusting the Tension Lever Position at the Unloading End (Fig. 5-87)

Checking

If the tension lever is not in position at the end of unloading, the tension lever is bent or tape slides off the tension lever. To prevent such a failure, check as follows:

1. Remove the cassette compartment assembly as directed in Section 5-3-1.
2. Press the EJECT button to set the loading disk ① in the unloading state.
3. Make certain that the clearance A between the cassette reference post ② and tension lever ③ is 5.5 to 7 mm (see Fig. 5-87).

Adjustment

If the measured clearance A is out of the range specified above, adjust as follows:

1. Loosen the screw ④. This will make the clearance A wider.
2. Put a bladed screwdriver into the space between the guide lever ⑤ and T-type cam follower ⑥ and turn the guide lever ⑤ in the arrow direction (↗) until the clearance is in the range of 5.5 to 7 mm.
3. Tighten the screw ④.

28-2. Checking the Tension Servomechanism Operation in Tape Loading (Fig. 5-88)

1. Remove the cassette cover as directed in Section 5-3-1.
2. Depress the cassette detect slider and EJECT button one after the other to repeat the loading and unloading operations several times.
3. In such operations, make certain that the tension lever ① of the tension servomechanism that operates in the first period of tape loading cannot be interfered with the post of the stop lever ②.
4. Set the loading disk in the loading end state.
5. Make certain that the clearance B between the tension lever ① and the post of the stop lever ② is 0 to 0.3 mm (see Fig. 5-88).
   NOTE: Improper clearance B can cause insufficient tape winding in the cue or review mode of operation, resulting in bad tape running.
6. Turn the tension lever ① in the arrow direction C lightly to make certain that the tension lever ① can be securely stopped by the post of the stop lever ②.

Adjustment

If in tape loading, the tension servomechanism will not run normally, adjust as follows:

1. Loosen the screw ③.
2. Put a bladed screwdriver into the space between the guide lever ④ and stop lever ② and adjust for normal operation.
3. Carry out Steps 2 through 6 in the "Checking" procedures above.

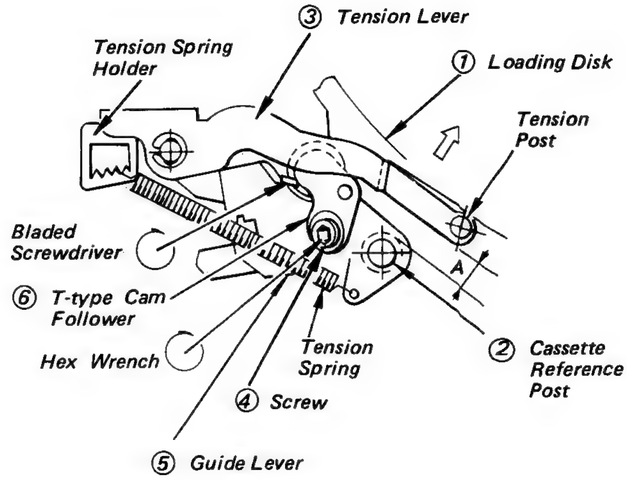


Fig. 5-87 Tension Lever Position Adjustment at Unloading End

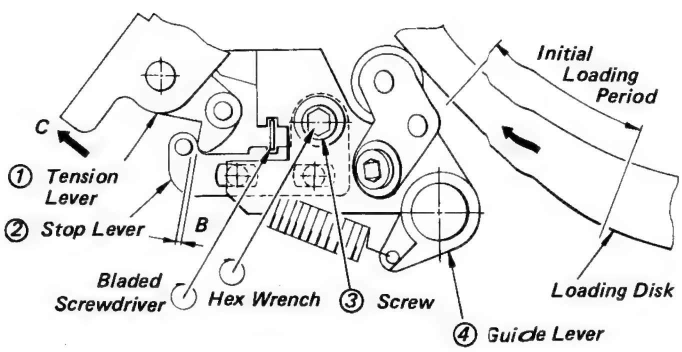


Fig. 5-88 Tension Servomechanism Opertio n Checking in Tape Loading

28-3. Checking and Adjusting the Band Brake Position (Fig. 5-89)

Checking

1. Set the loading end state without the cassette.
2. Set the playback mode of operation.
3. Make certain that the clearance C between the tension lever ① and capstan sleeve ② is in the range of 0.5 to 1.5 mm.

Adjustment

1. Remove the cassette compartment assembly.
2. Set the loading end state without the cassette.
3. Hold the slack lever.
4. Press the PLAY button.
5. Loosen the screw ③ .
6. Put a bladed screwdriver into the space of the band brake bracket ④ .
7. Adjust the band brake bracket ④ for obtaining the clearance C of 0.5 to 1.5 mm.
8. Tighten the screw ③ .
9. Repeat the playback mode and stop state one after the other several times to check for the clearance C.
10. Check for the back tension by following Section 5-3-29.

28-4. Replacing the Band Brake Assembly (Fig. 5-90)

Removal

1. Remove the cassette compartment assembly in the unloading end state.
2. Detach the hook of the band brake assembly ① from the tension lever ② .
3. Remove the screw ③ holding the band brake bracket.
4. Take out the brand brake assembly ① for removal.

Replacement

1. To reassemble the band brake assembly ①, reverse the "Removal" procedures, Steps 1 through 4, above.
2. Proceed with checking and adjustment by following Item 28-3, the "Checking and adjusting the band brake position", above.
3. Check for the back tension by following Section 5-3-29.

CAUTION: Particular care should be observed in handling the band brake assembly ① not to scratch nor bend it.

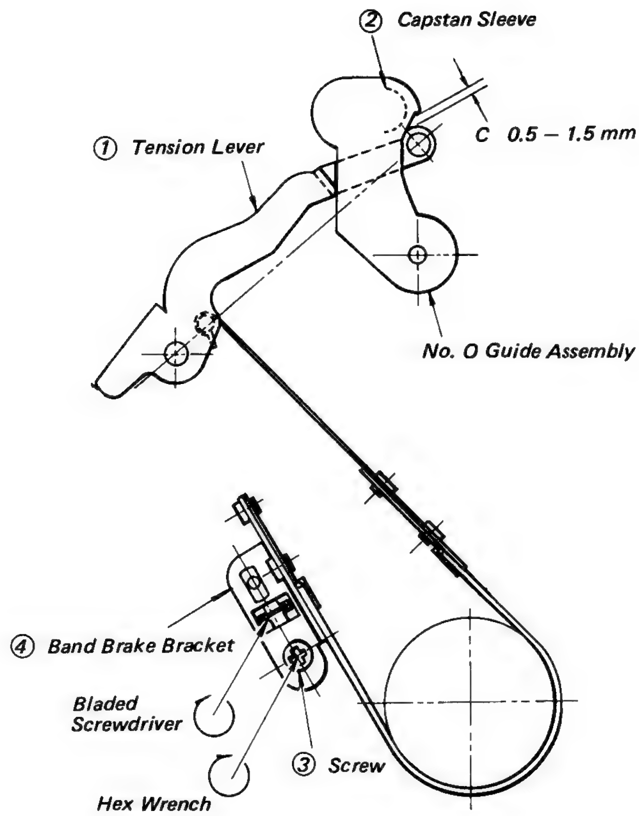


Fig. 5-89 Band Brake Position Adjustment

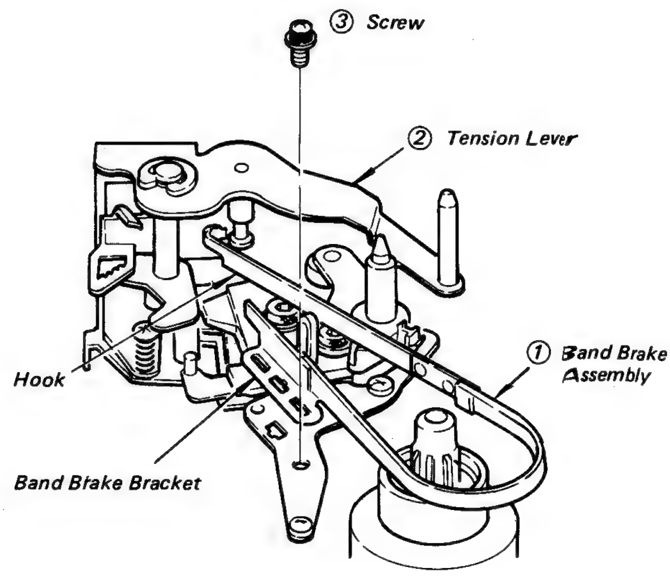


Fig. 5-90 Band Brake Assembly Removal

28-5, Replacing the Tension Servo mechanism (Fig. 5-91)
Removal

1. Detach the hook of the band brake assembly from the tension lever ⑤
2. Set the loading disk in the loading end state without a cassette.
3. Unhook the tension spring ① for removal from the tension spring holder ② .
4. Also, unhook the pawl of the guide lever ③ from the cassette detect bracket ④ .
5. Lift the guide lever assembly straight up for removal.

NOTE: Lifting the guide lever assembly may be interfered with the tension lever ⑤ . Then, it is advisable to turn the tension lever ⑤ in the arrow direction (↖) a little before lifting it.

6. Remove the two screws ⑥ holding the tension lever assembly ⑦ .
7. Lift the tension lever assembly ⑦ straight up for removal.

Installation

1. To reassemble the new components, reverse Steps 1 through 7 in the "Removal" procedures above.
   NOTE: Put the original hole of the shift lever ⑧ over the post of the link ⑨ for positioning before tightening the screws ⑥ to hold the tension lever assembly ⑦ .
2. Carry out checkings in:
   Item (1), "Checking and adjusting the tension lever position at the unloading end".
   Item (2), "Checking the tension servomechanism operation in tape loading".
   Item (3), "Checking and adjusting the band brake position".
   Item (4), "Checking the Back Tension in Recording and Playback Modes" as directed in Section 5-3-29.

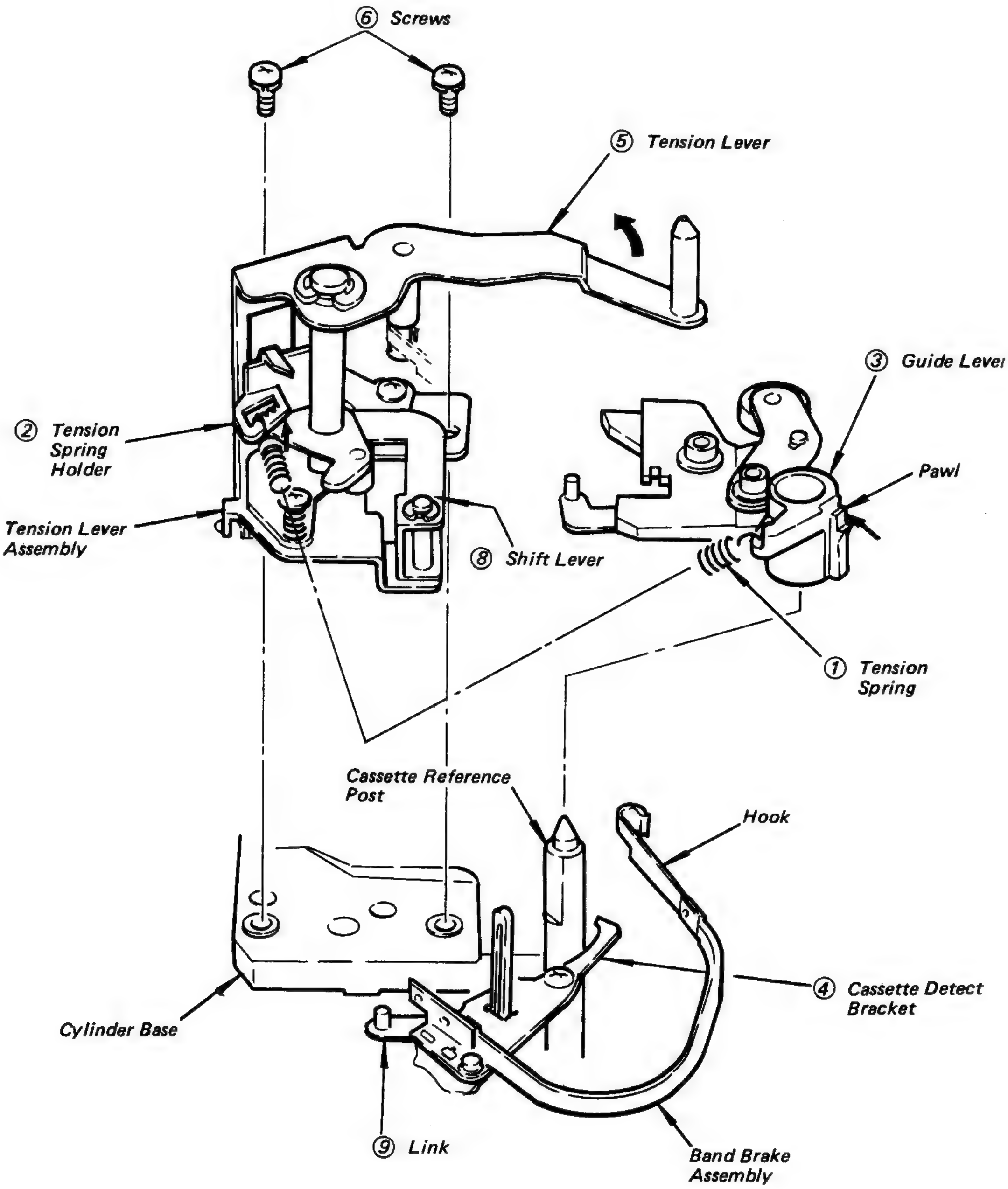


Fig. 5-91 Tension Servomechanism Removal

29. Checking and Adjusting the Back Tension in Recording and Playback Modes (Fig. 5-92)

In the recording (or audio dubbing) or playback mode of operation, the tape is given a uniform tension. This allows stable tape running. Too high back tension, however, can result in elongation of the tape. Too low back tension, on the other hand, can cause hunting on floating of the tape without fitting close to the heads. To prevent such a tape failure, check and adjust for the back tension as follows:

Checking

1. Remove the cassette compartment assembly as directed in Section 5-3-1.
2. Set the loading disk in the loading end state.
3. Install the tension bracket (jig) in position on the right-hand frame.
4. Mount the playback forward back tension measuring jig fixture ② in position on the supply reel table.
5. Wind the tape as illustrated in Fig. 5-92.
6. Press the PLAY button to transport the tape. The tape will be pulled at a speed of 18 mm/sec.
7. Make certain that the back tension is in the range of 40 to 50 g.

Adjustment

1. Adjust the tension spring ③ by shifting its hook position. The back tension becomes higher in the direction A (←) and it is lower in the direction B (→).
2. Replace the band brake if the back tension difference between the beginning and end of winding the tape is not greater than 10 g or if the back tension changes to much.
3. Also, replace the band brake assembly if this was damaged too hard in replacing a reel table.

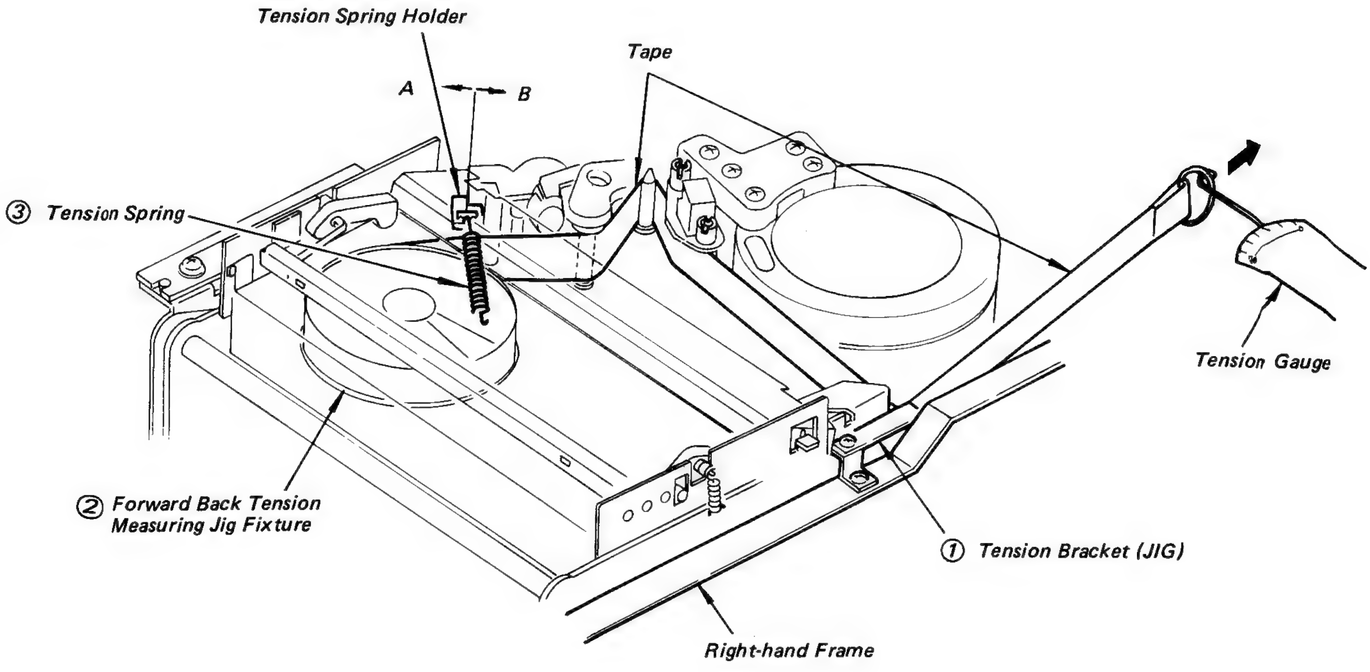


Fig. 5-92 Back Tension Adjustment

30. Capstan Drive Assembly

30-1. Checking the Flat Capstan Drive Belt (Fig. 5-93)

Dirty, scratched, or worn capstan drive flat belt, if any, adversely affects the tone and picture quality. The flat belt, therefore, should be periodically checked and replaced, if needed, as directed below:

Checking

1. Check to insure that the flat belt is free of dirt, scratch, wear, and excess elongation.
2. For dirt, wipe the flat belt using isoplopyl alcohol. For scratch, wear, or excess elongation, replace one.

Replacing (Fig. 5-93)

1. Remove the two screws ① holding the thrust bearing bracket ② .
2. Lift the thrust bearing bracket ② upward for removal.
3. Wipe new flat belt clean using isoplopyl alcohol, before replacement.

To replace the capstan drive flat belt ④ follows:

4. Put the capstan drive flat belt ④ to the motor pulley first.

CAUTION: When installing the capstan drive flat belt ④ , the white mark should face outside.

5. Put the capstan drive flat belt ④ to the capstan flywheel ③ .
6. Place the thrust bearing bracket ② in position.
7. Tighten the two screws ① .

30-2. Replacing the Capstan Motor (Fig. 5-94)

To replace the capstan motor, proceed as follows:

1. Take out the capstan drive flat belt ④ for removal from the motor pulley.
2. Remove the three screws ⑧ holding the capstan motor assembly ⑨ .
3. Take out the capstan motor assembly ⑨ for removal from the cylinder base ⑩ .
4. To replace the capstan motor assembly ⑨ , reverse step 1 through 3.

CAUTION: When removing and replacing the capstan motor, care must be exercised not to scratch the flat belt and motor pulley.

30-3. Note on Tape Speed

In the V-8600B, tape running is controlled to maintain the standard speed at all times by a detection arrangement of the capstan revolution. The tape speed was adjusted before shipment of the equipment from the factory. Therefore, it is not necessary to check and adjust the tape speed after the capstan motor or capstan drive flat belt has been replaced.

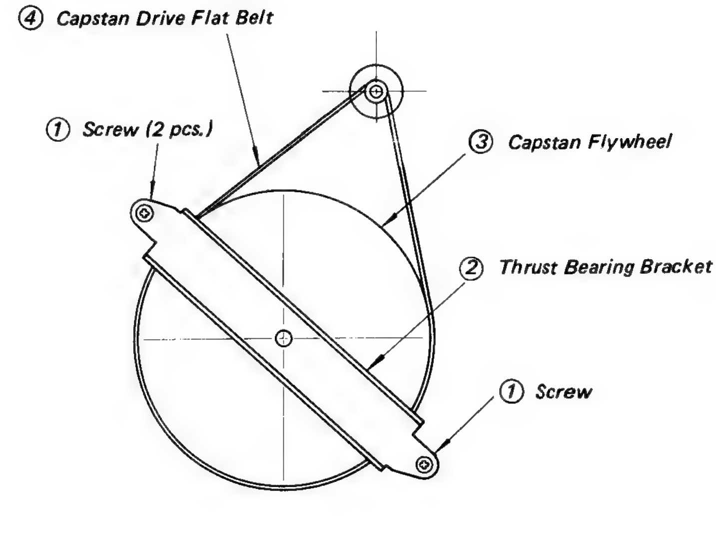


Fig. 5-93 Capstan Drive Flat Belt Removal

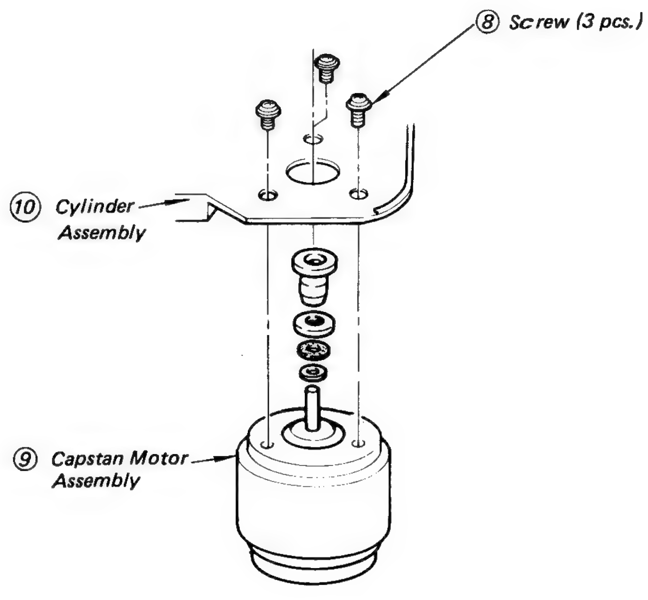


Fig. 5-94 Capstan Motor Removal

30-4. Replacing the FG Coil Assembly (Figs. 5-95, 5-96)
When the wire of the coil assembly is cut off, replace it proceed as below:

Replacing

1. Disconnect the connector of the Servo II Board.
2. Loosen two screws ③ and remove the thrust bearing assembly ④.
3. Remove the capstan drive flat belt ⑤.

NOTE: Do not touch the belt by bare hand.

4. Remove the capstan flywheel assembly ⑥.
5. Loosen three screws ⑦ and remove the tack plate assembly ⑧.
6. Loosen the screws ⑮ and remove the wire clamp ⑩ holding the cylinder base ⑪.
7. Remove the coil ① holding the capstan FG bracket ⑨.

NOTE: Be careful to damage the lead wire when taking out the connector ②.

8. Replace the coil assembly ① by reversing steps 1 through 7.

CAUTION: When install the tack plate assembly ⑧, adjust connection of the tack plate assembly ⑧ using the jig (A) ⑫ and jig (B) ⑭.

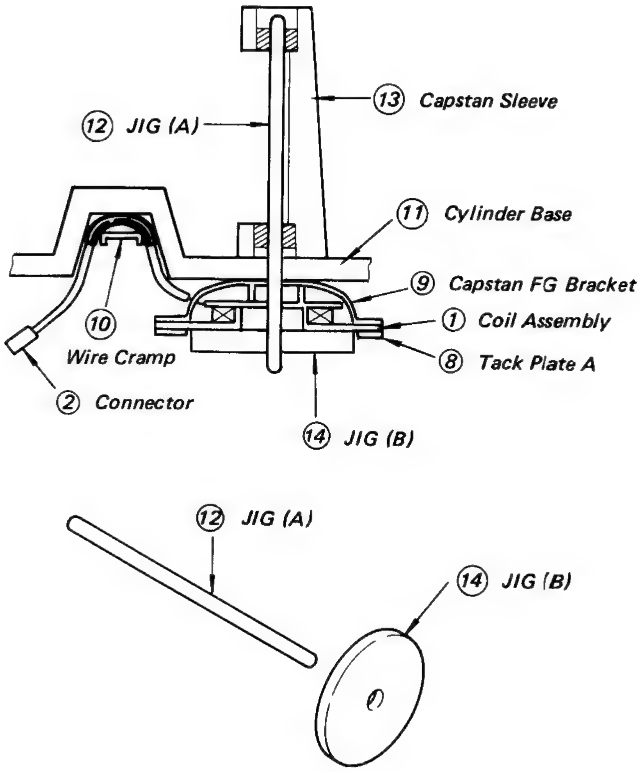


Fig. 5-95 Tack Plate Assembly Adjustment

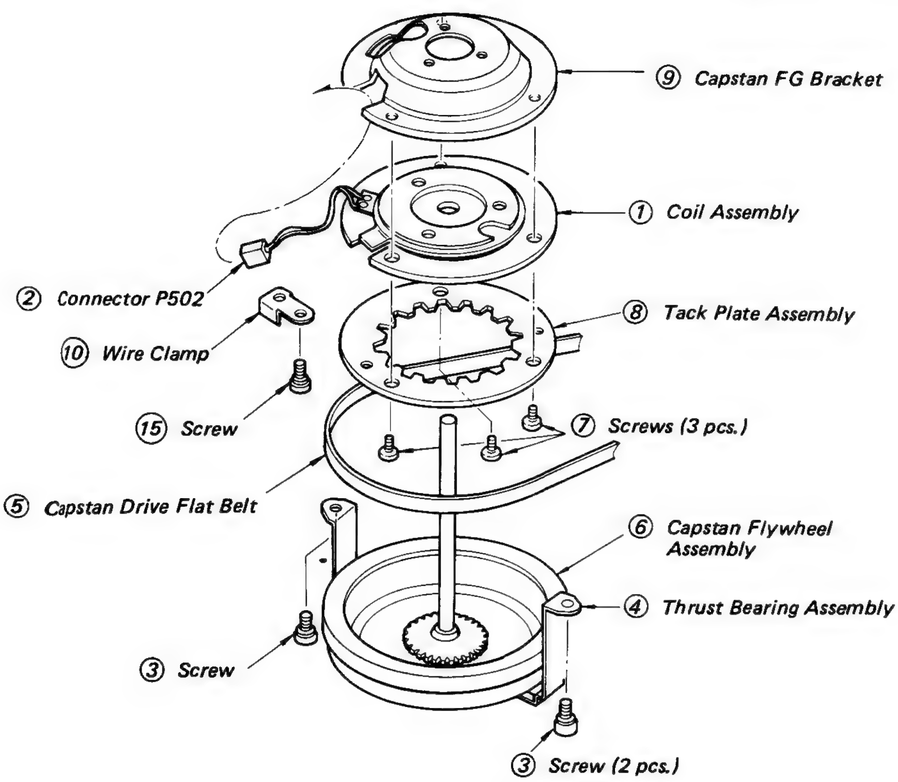


Fig. 5-96 Tack Plate Assembly Removal

31. Cylinder Assembly

31-1. Checking the Tape Retainer Spring

The tape retainer spring makes the tape to move along the tape guide lead of the lower cylinder, thereby assuring stable running can be seen by light reflection from the surface of the tape pressed a little inward by the tip of the tape retainer spring. The tape path can be adjusted by checking the tape retainer spring assembly and tape running condition. If the tape retainer spring is deformed too much or its pressure is too low, the envelope wave form cannot be normal. Then, replace the tape retainer spring assembly by following Item (31-2) below.

31-2. Replacing the Tape Retainer Spring Assembly (see Fig. 5-97)

1. Remove the top cover.
2. Remove the one screw ① holding the tape retainer spring assembly ② .
3. Replace the tape retainer spring assembly by reversing Steps 1 and 2.

NOTE: In installation, put the tape retainer spring assembly fully toward the arrow (↖) direction.

Checking After Replacement

Playback the monoscope section of the alignment tape and observe the picture on the monitor TV to check that it is normal.

31-3. Checking the Dew Heater (see Fig. 5-98)

The dew heater raises up the temperature of the cylinder to prevent dew from sticking tape to the cylinder. The dew heater is powered on or off according to the table below.

Operation / Mode		Power
Power Switch OFF	Cylinder Motor Stop	O
Power Switch ON	Cylinder Motor Rotate	X
	Cylinder Motor Stop	O
Timer ON	Cylinder Motor Rotate	X
Timer Standby	Cylinder Motor Stop	O

Checking

1. Check to insure that the power is supplied into the VTR.
2. Turn the set power on, and the operation is in the stop mode.
3. Wait 4 to 5 seconds, touch the dew heater by finger and make certain that the dew heater is heated.

Adjustment

1. If the dew heater is not heated up, check whether the voltage is supplied to the connector P606.
2. If so, the dew heater is fault.
   Replace it by following item (31-4).

31-4. Replacing the Dew Heater (see Fig. 5-98)

1. Remove the upper cover.
2. Unsolder the lead wire ③ after unclamping it from the lead clamper.
3. Remove the two screws ⑥ holding the dew heater to the upper cylinder.
4. Replace the dew heater by reversing Steps 1 through 3.
   a. In installing, tighten one of the screws ⑥ to hold the lead wire ⑤ together with the washer ⑦ and one end of the dew heater ① and tighten the other screw ⑥ to hold the other end.
   b. Mount vinyl tube ④ on the lead wire ③ to cover.
   c. Solder the lead wire ③ .

31-5. Checking the Cylinder Motor

The cylinder motor revolves the video head disk assembly and reel table, in playback controlled to a constant speed of 1,500 rpm by the Servo Circuit. In Fast-Forward or rewinding, the disk motor rotates at a high speed of approximately 3,600 rpm for low load at the start of winding and at a low speed of approximately 3,400 rpm for high load at the end of winding as it is a DC motor.

Checking

1. If the motor is not revolved, first check the electrical wiring.
2. Apply power to the cylinder motor only.
3. If it will not revolve, it can be determined that the cylinder motor is at fault. Replace the rotor or stator by following.

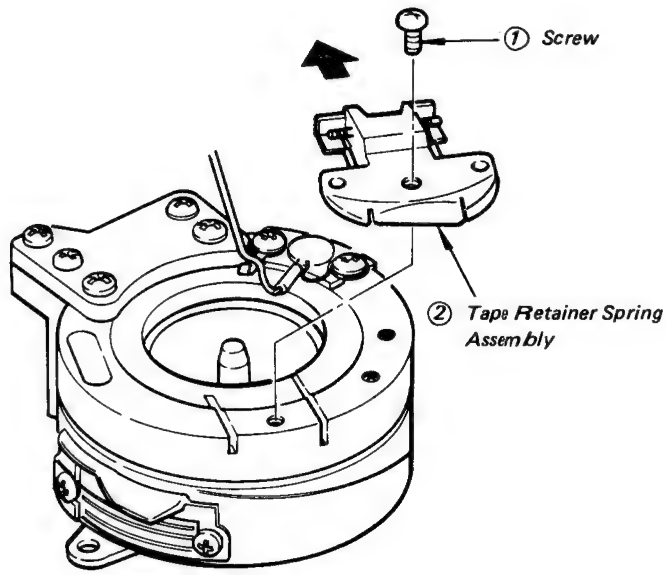


Fig. 5-97 Tape Retainer Spring Assembly

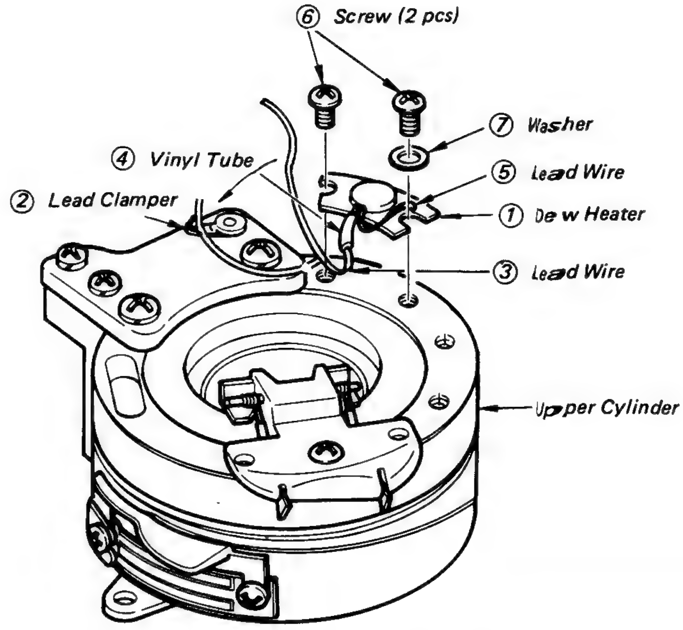


Fig. 5-98 Replacement of Dew Heater

31-6. Replacing the Rotor or Stator of the Cylinder Motor (see Fig. 5-99)

To replace the rotor, proceed as follows:

1. Remove the cabinet by following Section the "How To Remove the Cabinet" as directed in Section 5-3-1.
2. Remove the Video Circuit and Servo Circuit Boards located just above the bottom cover.
3. Slide the reel drive belt off for removal.
4. Remove the two screws ⑦ holding the rotor ⑥.
5. Lift the rotor ⑥ straight up for removal.
6. Replace by reversing Steps 1 through 5.

CAUTIONS: 1. The two screws ⑦ should be torqued 6 kg·cm, approximately.
2. After tightening the two screws ⑦, paint on the two screws ⑦ to lock.

To replace the stator, proceed with Steps 1 through 5 above, proceed as follows:

7. Push the 3-pin connector ⑧.
8. Remove the two screws ⑤ holding the stator ④ to the lower cylinder assembly.
9. Extract the stator ④ upward for removal.
10. Replace the stator by reversing Steps 7 through 9.

CAUTIONS: 1. In installation of the stator, the three pins of the connector ⑧ should be directed toward the length of the slit on the case.
2. After tightening the two screws ⑤, paint on each screw to lock.

31-7. Checking and Replacing the Upper Cylinder (see Fig. 5-100)

Check the upper cylinder for scratches, abrasion, and other defects. If any, replace as follows:

Replacement

1. Remove the upper cover.
2. Remove the tape retainer spring assembly ②, and dew heater ③ mounted on the upper cylinder ⑤.
3. Remove the three screws ⑪ holding the upper cylinder ⑤.

IMPORTANT: **Never remove the two screws ⑩ holding the bracket ⑧ to the connector. Otherwise, the upper cylinder ⑤ will not be replaced in the original position.**

4. Turn the video head assembly ⑬ around so that one head face the incoming tape side and the other head may face the outgoing tape side.
5. Slide the upper cylinder ⑤ and lift it straight up for removal.
6. Replace the upper cylinder ⑤ as follows:
   a. Temporarily tighten the three screws ⑪ to hold the upper cylinder ⑤ to the bracket ⑧.
   b. While pressing the upper cylinder ⑤, to the arrow (↖) direction, firmly tighten the three screws 11, allowing no gap therebetween.
   c. Install the tape retainer spring ② and dew heater ③, in position. Clamp the lead wire ⑰ by lead clamper to prevent the lead wire ⑰ slacken.

Checking After Replacement

1. Playback the monoscope section of the alignment tape and observe the envelope wave form on the oscilloscope.
2. If the observed envelope wave form is not well, perform the tape path adjustment as will be directed in Section 5-3-34.

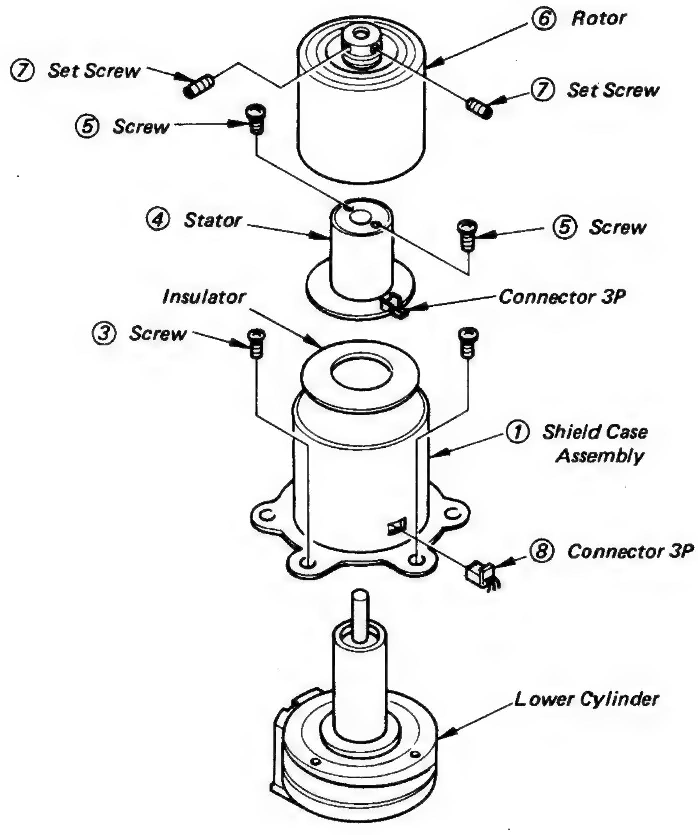


Fig. 5-99 Exploded View of Cylinder Motor Assembly

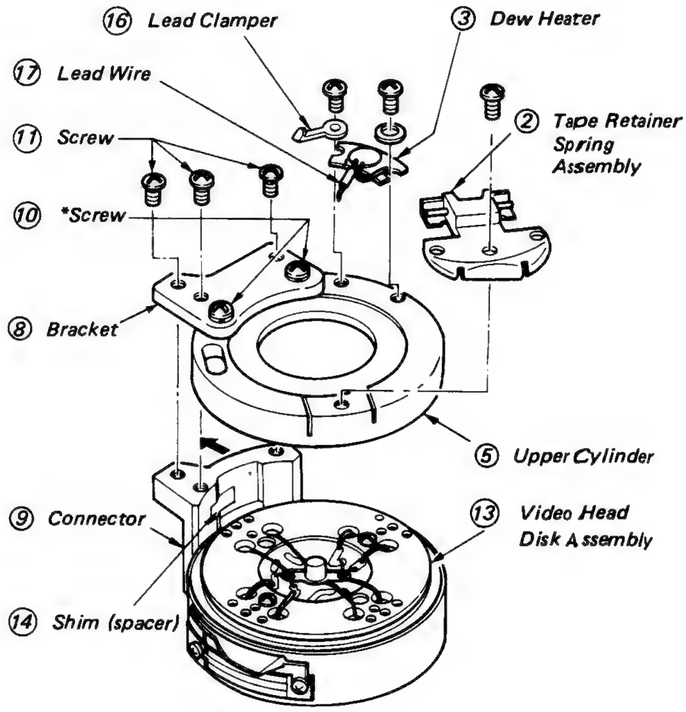


Fig. 5-100 Upper Cylinder Installation

31-8. Checking the Cylinder Assembly (see Fig. 5-101)
The cylinder assembly serves both for transporting tape and supporting the cylinder motor that revolves the video head cylinder assembly.

Checking
Check the tape passing surface of the lower cylinder for scratches and other defects. If any, this adversely affects tape transportation. Then, replace the cylinder assembly. If the cylinder assembly will not rotate freely, this is due to defective bearing. Also, replace the cylinder assembly by following Item 31-9 below.

31-9. Replacing the Cylinder Assembly (see Figs. 5-101, 102)
1. Remove the cabinet as directed in Section 5-3-1.
2. Remove the Video/Servo board and Tuner Block.
3. Disconnect the connector P101, P102 from VIDEO II Board, P503, P508, P606 from SERVO LOGIC Board.
4. Make the disconnected lead wire free of the clampers and bring them under the cylinder assembly.
5. Remove the two screws (13) and the take the cylinder assembly out straightly upward from the cylinder base.
6. Remove the rotor, stator and insulator of cylinder motor.(Refer to section 31-6)
7. Remove the three screws (3) and take the shield case out.
8. Replace the cylinder assembly by reversing steps 7 to 6.
9. In installation, temporarily tighten the two screws (13) after confirmed the cylinder assembly should be fixed in the cylinder base guide pins, and turn the cylinder assembly clockwise to press as viewed upward, then firmly tighten the two screws (13) .

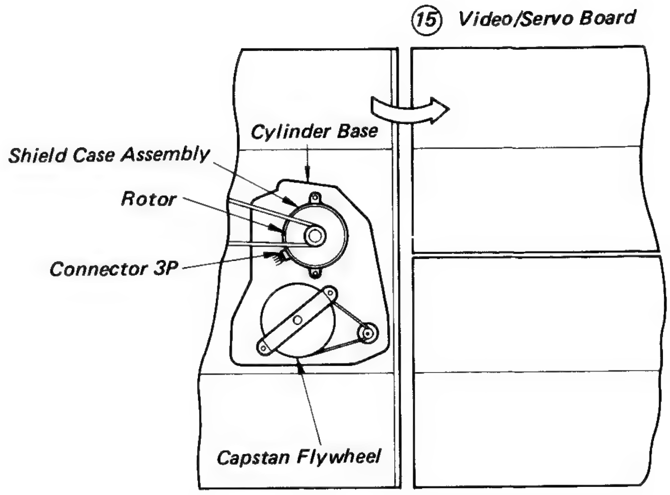


Fig. 5-101 Replacement of Cylinder Assembly (1)

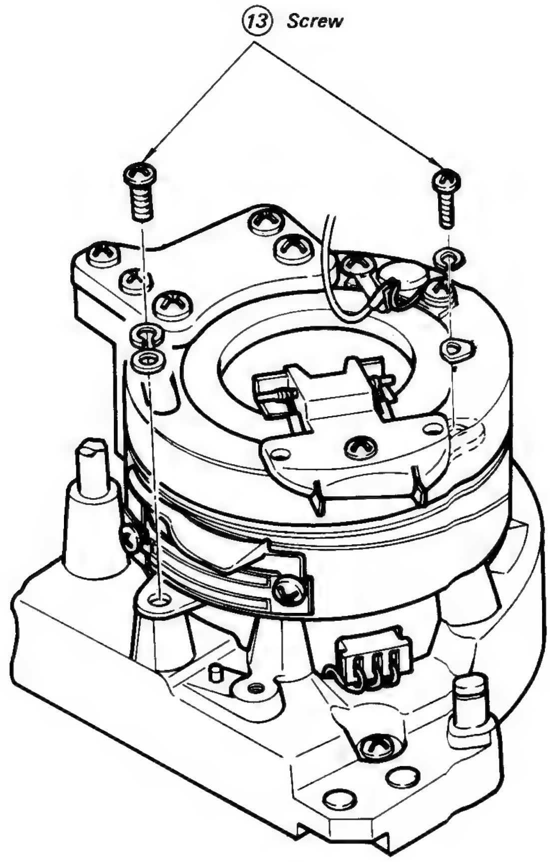


Fig. 5-102 Replacement of Cylinder Assembly (2)

31-10. Checking and Replacing the Video Head Disk Assembly

In the event one or the others video heads are broken or with dust that cannot be removed with use of the "Life End" or cleaning tape, replace the video head disk assembly as follows:

Checking

1. Check the each video head has damage, wear or clogging.
2. If the video head cannot be refurbished, particularly by wiping it with cleaning bar moisted in the isopropyl alcohol, replace it.

Replacement

1. Remove the top cover.
2. Remove the dew heater and the upper cylinder.
3. Unsolder the eight video head disk wires⑥ going to the relay PC board ⑦.
4. Remove the two screws ⑯ holding the video head disk assembly ①.
5. Replace the video head disk assembly ① leaving the spacer, if any on the flange.
6. Clean the upper and lower surface of video head disk assembly ① with cleaning bar moisted with the isopropyl alcohol, and also, wipe the surface of the spacer, if any.
7. Align the video head disk assembly in position with the mark (▲) on the video head disk assembly and the mark (▲) on the intermediate board.
8. Temporarily tighten the two screws ⑯ to hold the video head disk assembly ① to the flange ⑰ as light as a possible, eccentricity of the video head disk assembly ① can be adjusted, using a screwdriver by two fingers.

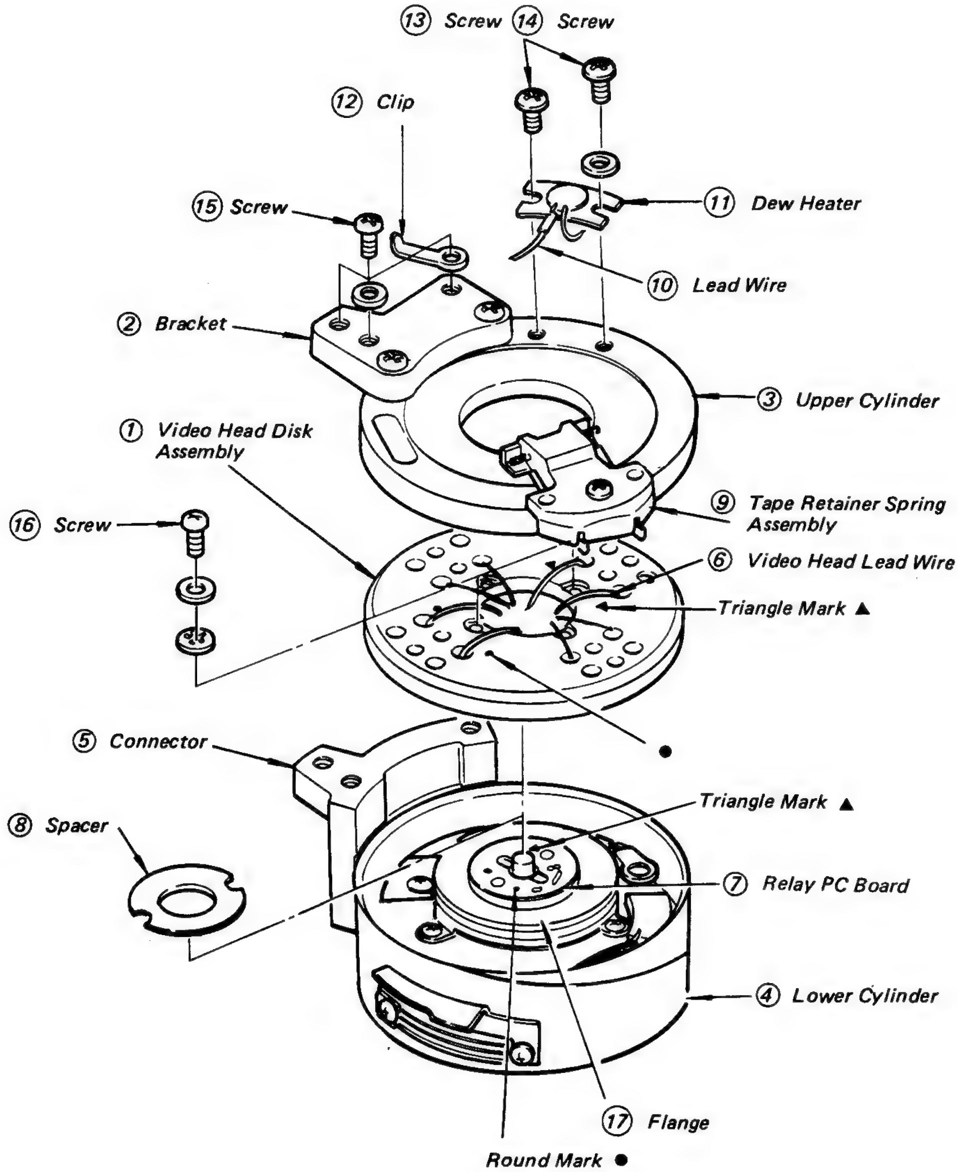


Fig. 5-103 Replacement of Video Head Disk Assembly

31-11. Adjusting the Eccentricity of the Video Head Disk Assembly (see Figs. 5-104, 105, 106, 107)

Positioning the Video Head Disk Assembly Eccentricity Gauge

1. Lift the cassette compartment assembly up.
2. Remove the two screws ② holding the cassette opener, and move the cassette opener to the cylinder assembly side.
3. Reassemble the retainer of eccentricity guage ③ as the taper of retainer should be come inside and the scale ④ is in the vertical position. (see Fig. 5-105)
4. Fix the eccentricity guage ③ with the wing screw ⑤ on the right frame of chassis.
5. Position the probe of eccentricity gauge ③ should be come the top of video head disk assembly.

NOTE: The gauge of the probe and the retainer of eccentricity gauge should be kept about 25 degrees. (see Fig. 5-105)

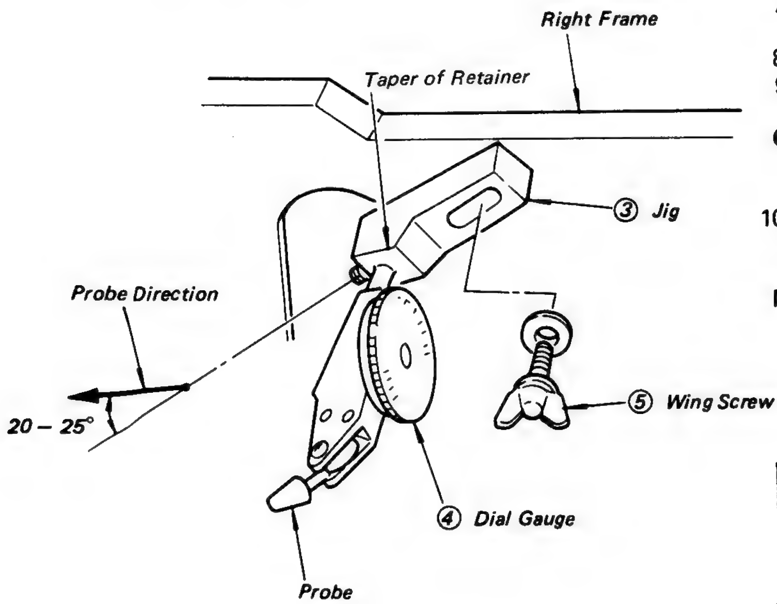


Fig. 5-105 Adjusting the Eccentricity Gauge

Adjustment

1. Loosen the wing screw ⑤ and adjust the dial gauge ④ so that the needle is at the center of the scale (see Figs. 5-106, 5-107).
2. Tighten the wing screw ⑤.
3. While gently turning the video head disk assembly ⑥ clockwise by hand, read the dial gauge ④.
4. When the dial gauge ④ indicates that the video head disk assembly ⑥ is most eccentric to the dial gauge ④ side, stop turning the video head disk assembly ⑥ (see Fig. 5-107).
5. Fit a bladed screwdriver on the inside surface of the video head disk assembly ⑥ and lightly tap it until the needle returns a half of the maximum deflection measured in Steps 1 through 4 above.
6. Repeat the adjustment in Step 5 above several times until the needle deflects as little as possible when the video head disk assembly is rotated. (minimum eccentricity.)

NOTE: The standard eccentricity is within 1 μ.

7. After adjustment, tighten the two screws ⑪ little by little alternately. Torque each screw to more than 10 kg.
8. Check the cylinder eccentricity again.
9. Solder the video head wires ⑨ to the relay PC board ⑩.

CAUTION: Fit the wires close to the video head disk assembly so as not to allow them to touch the upper cylinder.

10. Reassemble the upper cylinder in accordance with Section 31-7, the "Checking and Replacement of Upper Cylinder".

NOTE: Confirm the screw ⑥ do not attached the video head disk.

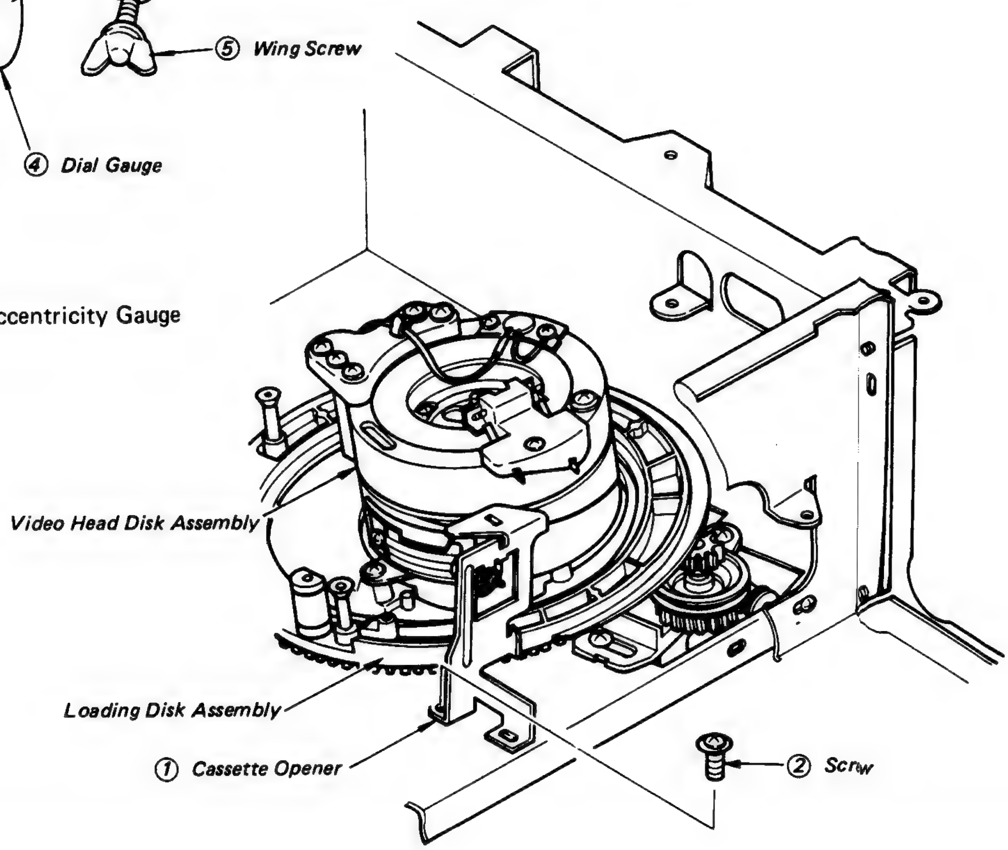


Fig. 5-104 Adjusting the Eccentricity Gauge

32. Replacing the Exit Guide Assembly

Replaceing the Exit Guide Assembly (see Figs. 5-108, 109)

1. Remove the two CTL/AUDIO position adjustment screws ①.
2. Lifting the exit guide assembly ② upward, unsolder the wires.
3. Assemble the exit guide assembly by reversing Steps 1 through 2.

CAUTION: Before tightening the screws ①, put the lead wires under the exit guide assembly.
  a. The yellow audio head wires should be far away from the cylinder assembly.
  b. The lead wires should not be clipped between the connector for the cylinder assembly and the exit guide assembly.

4. Perform tape path adjustment.

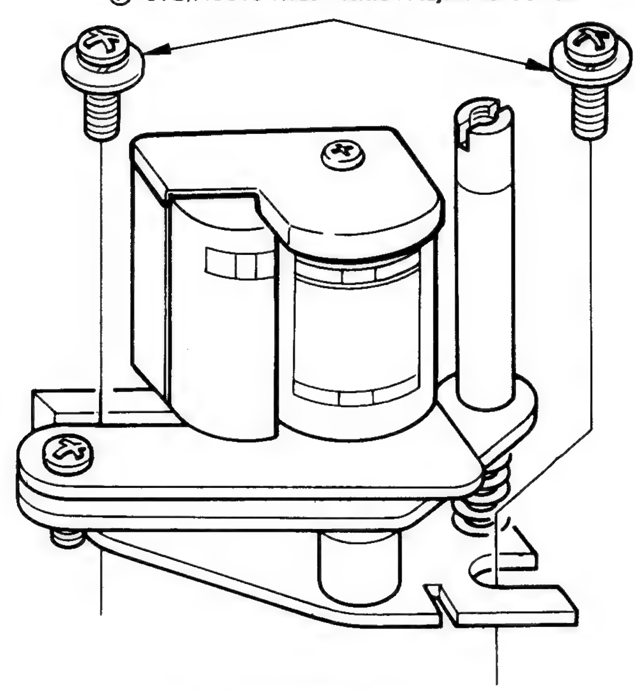


Fig. 5-108 Exit Guide Assembly (1)

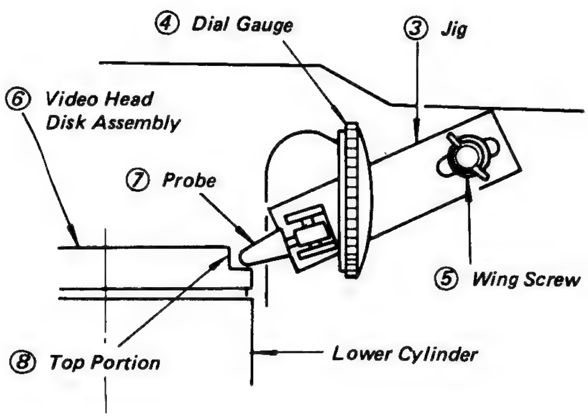


Fig. 5-106 Adjusting the Eccentricity Gauge

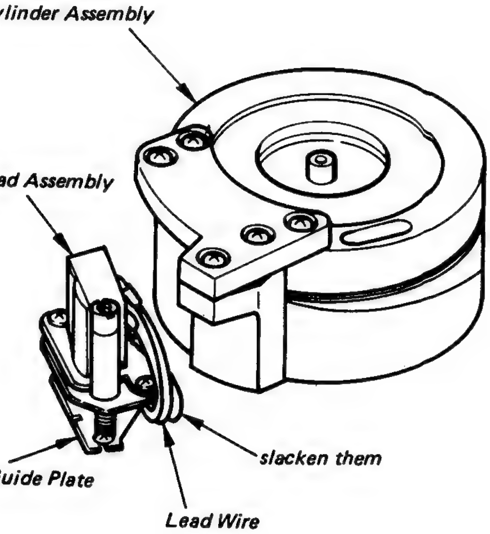


Fig. 5-109 Exit Guide Assembly (2)

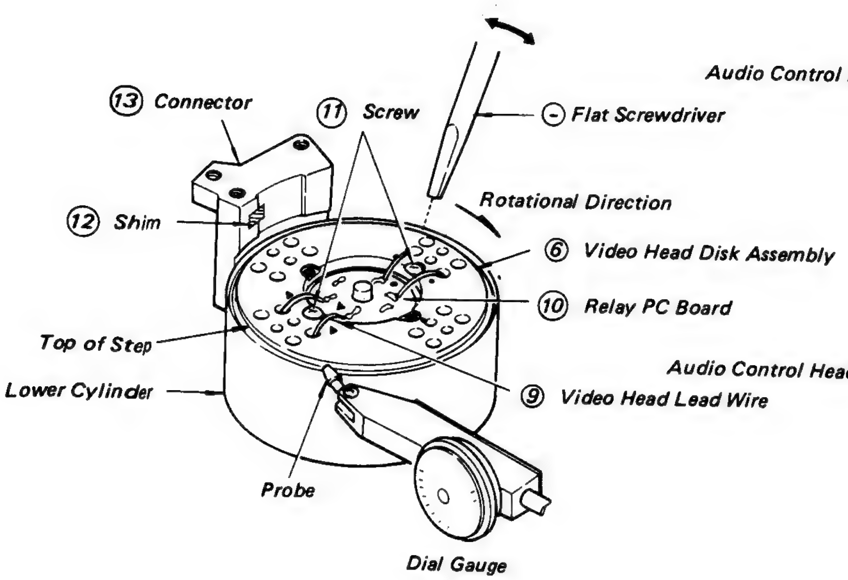


Fig. 5-107 Adjusting the Eccentricity Gauge

33. Replacing the Fully Width Erase Head Assembly (Figs. 5-110, 5-111, 5-112)

1. Unclamping the lead wire from the lead clamper, and the wires slack down.
2. Remove the nuts ① and ②.
3. Remove the upper entrance guide plate ③ the impedance roller ④, the entrance guide spacer ⑤, the entrance guide pole ⑥, the lower entrance guide plate ⑦, and the two springs ⑧.
4. Lifting the fully width erase head ⑨ upward and unsoldering the lead wires.
5. Reassemble the fully width erase head ⑨ by reversing steps 1 through 4.
6. Clamp the wire not to slack down and do not touch the impedance roller ④.
7. Perform the tape path adjustment as will be described in Section 5-3-34.

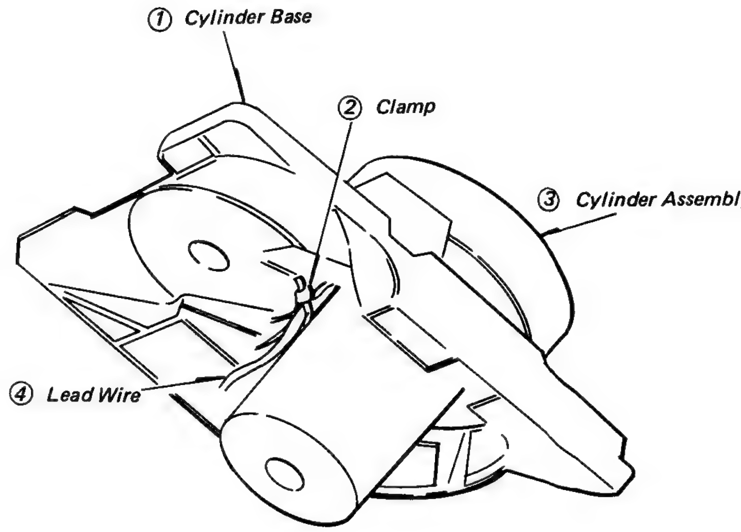


Fig. 5-110 How to Slacken the Lead Wires

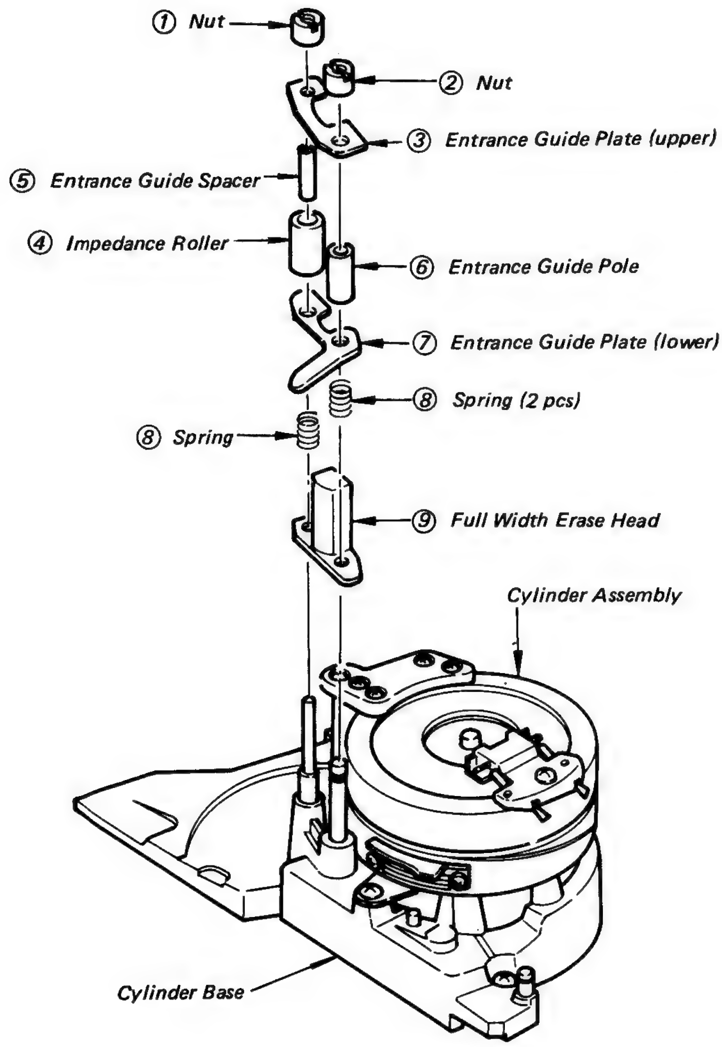


Fig. 5-111 Full Width Erase Head

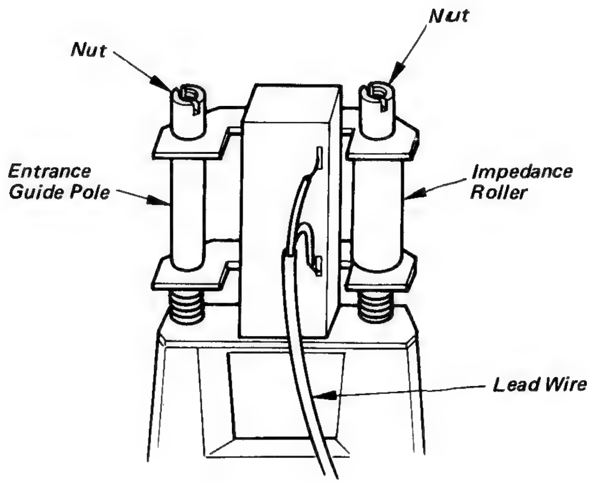


Fig. 5-112 Wiring the Fully Width Erase Head Assembly Around

34. Tracking Adjustment

34-a. Method of tape path alignment

1. Misalignment of tape path → Proceed Entrance guide adjustment. (refer to Fig. 5-115)
   → Proceed Exit guide adjustment. (refer to Fig. 5-116)
2. Replacement of tension lever assembly → Proceed rough alignment. (refer to Section 34-b)
3. Replacement of upper cylinder assembly and cylinder assembly
   ↓
   check the tape path → Proceed Entrance guide adjustment. (refer to Fig. 5-115)
   → Proceed Exit guide adjustment. (refer to Fig. 5-116)
4. Replacement of Video head disk assembly
   ↓
   check the tape path → Proceed Entrance guide adjustment. (refer to Fig. 5-115)
   → Proceed Exit guide adjustment. (refer to Fig. 5-116)
5. Replacement of Exit guide assembly (Audio/control head assembly) → Proceed rough alignment. (refer to Section 34-b)
6. Replacement of Full width erase head → Proceed Entrance guide adjustment. (refer to Fig. 5-115)

CAUTION: Before tape path alignment, proceed the rough alignment with using the recorded tape.

34-b. Rough adjustment (see Figs. 5-113, 5-113a, 5-113b)

CAUTION: In rough adjustment, alignment test tape should not be used as it could be injured.

In rough adjustment, the tape transport arrangement should be checked in the playback mode of operation.

1. Check the tape on the flange guide for curl.
2. Check the tape at the inlet and outlet of the capstan for wrinkle and curl.
3. If there is any curl or wrinkle, adjust the nuts ①, ②, ③, and ④ until it is eliminated, while running the tape along the upper flange of the tape guide.
4. In adjustment, also, check the clearance between the tape and the upper flange of the tape guide using the dental mirror.

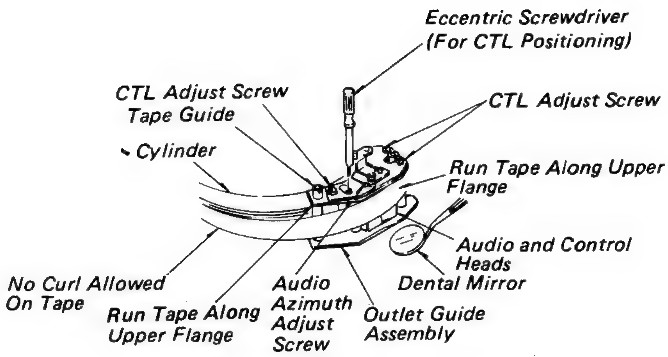


Fig. 5-113-A Tape Transport Adjustment A

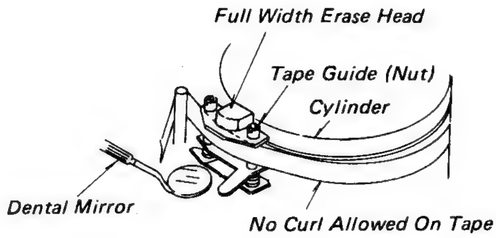


Fig. 5-113-B Tape Transport Adjustment B

34-c. Tracking adjustment should be done under the following steps in sequence:

Tracking adjustment should be done under the following steps in sequence:

1. Tape Path Alignment
2. Audio Azimuth Alignment.
3. Audio/Control Head Height Alignment.
4. Control Head Position Alignment.

34-1. Instrument and Tools Required

[Tools]

Alignment Test Tape (KR5-1C).
Oscilloscope (Dual Trace Type).
Dental Mirror (to check the tape transportation).
Isopropyl alcohol with Cleaning bar.

[Test Point]

TP-101 Envelope. Envelope.
TP-501 RF Switching Pulse.
TP-514 Control Pulse.

34-1. Tape Path Alignment (see Fig. 5-113)

If the tape path is misaligned, this considerably affects the performance characteristics of the VTR, for example, disturbs the picture, scratches tape, and results in no VTR interchangeability in which the tape recorded by one VTR cannot be normally played back by another.

Whenever any of the services listed below has been carried out, checking must be performed in the audio line output level and envelope wave form and inner curling in the tape path guide system. Tape path adjustment, also, should be performed in necessary.

a. Tension lever assembly replacement.
b. Upper and lower cylinder removal and installation.
c. Video head disk assembly removal and installation.
d. Audio and control head removal and installation.
e. Full width erase head removal and installation.

CAUTION: Servicemen should be fully trained in the tape path adjustment as this requires highly-advanced technique and skill.

1. Before done this alignment, clean the tape guides, the surface of cylinder, the pinch roller, the capstan and around the parts, by using the isopropyl alcohol with the cleaning bar or the cotton clothes.
2. Connect the probe of oscilloscope to TP-101, and apply the external trigger from TP-501 to the oscilloscope.
3. Playback the monochrome section of alignment tape, and confirm whether the level of envelope should vary flatly when turn the tracking knob to both direction from the center click position.
   Unless the level of envelope is flat, adjustment should be employed the following steps 5-a and 5-b.
4. When the level of envelope becomes maximum by turning the tracking knob, confirm the level of envelope should be shown in Fig. 5-114.
   If the level of envelope is not shown the figure, adjustment should be employed the following steps 5-a and 5-b.

5-a. Entrance side adjustment (Fig. 5-115)
If the level of envelope is shown Fig. 5-114(a), adjust the height of 1st guide ③ and 2nd guide ④ to obtain the flat level.
Attention, do not tighten the 1st guide ③ too much since the level of envelope at entrance side will be varied easily.

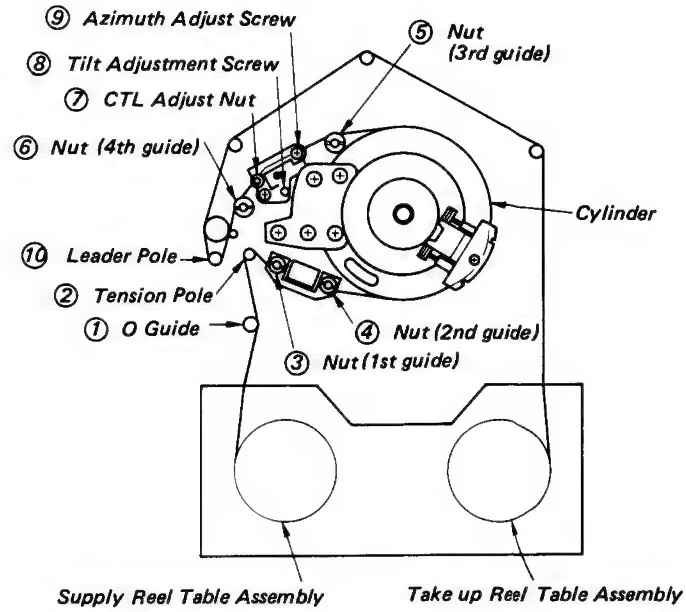
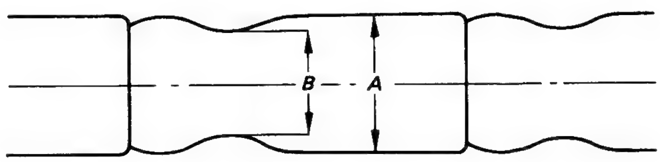


Fig. 5-113 Tape Pass Adjustment



B/A > 0.7

Fig. 5-114 Envelope Waveform

5-b. Exit side adjustment **(Fig. 5-116)**

If the level of envelope at the exit side is not flat as shown Fig. 5-114(b), adjust the height of 3rd ⑤ and 4th ⑥ guides to obtain the flat level.

Confirm the tape has no curl or wrinkle at guide 3rd ⑤ or 4th ⑥ when playing back L-750 type cassette.

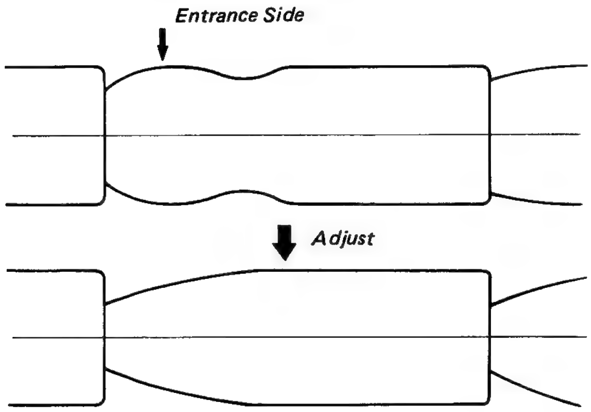


Fig. 5-114(a) Level of Envelope

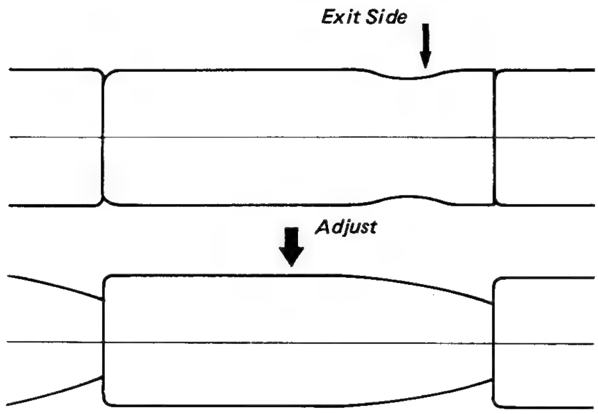


Fig. 5-114(b) Level of Envelope

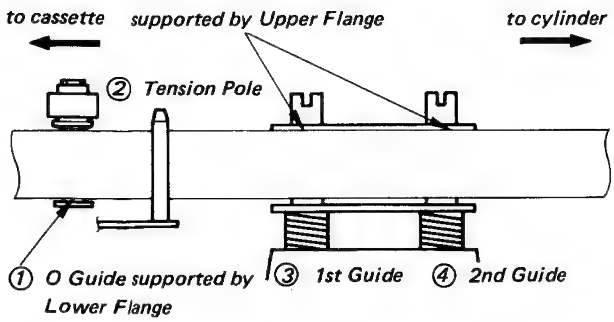


Fig. 5-115 Entrance Side Tape Path Adjustment

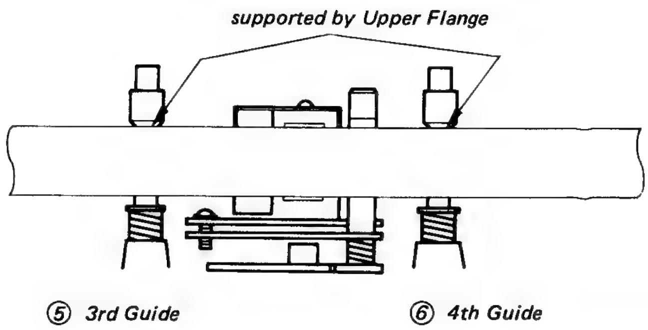


Fig. 5-116 Exit Side Tape Path

34-2. Entrance Side Adjustment After Replacement of the Tension Lever Assembly

This adjustment is not necessary if the tape has no curl or wrinkle after replacement of the tension lever assembly.
If the tape has curl or wrinkle, adjust the entrance side tape guides as described in step 5-a.
If the tape has still curl or wrinkle after adjusting the above 5-a, confirm and adjust as follows:

A. Checking the vertical angle of tension pole (Figs. 5-117, 5-118, 5-119, 5-120)
Hold the tool for adjusting the height of the cassette reference plate to the tape tension pole and make certain that clearance is 0.1 or less. If the clearance is large, adjust by turning the adjustment screw ②, ③.

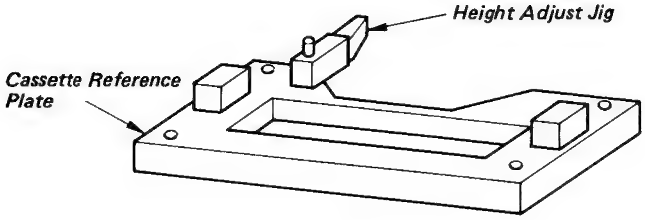


Fig. 5-117 Cassette Reference Plate

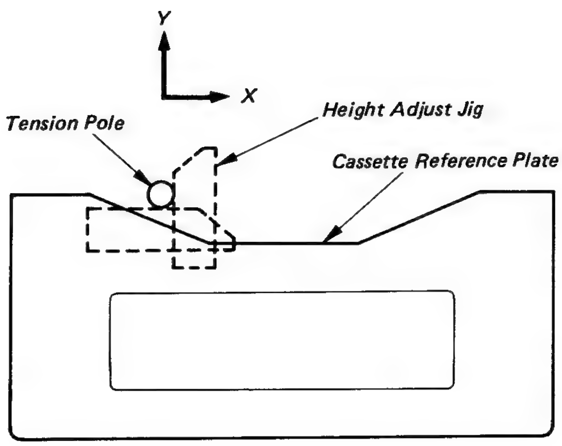


Fig. 5-118 Checking the Vertical Angle of Tension Pole (1)

B. O Guide Height Adjustment (5-117, 5-121)
Adjust the height of O guide height with height adjusting tool to 18.75 mm high from the cassette base reference level.

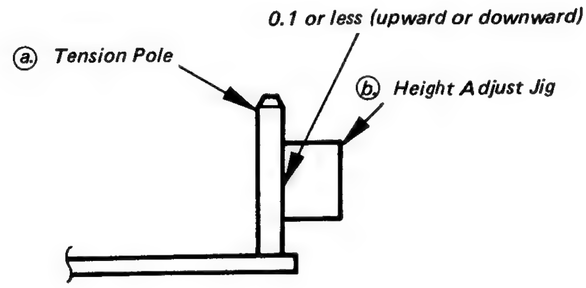


Fig. 5-119 Checking the Vertical Angle of Tension Pole (2)

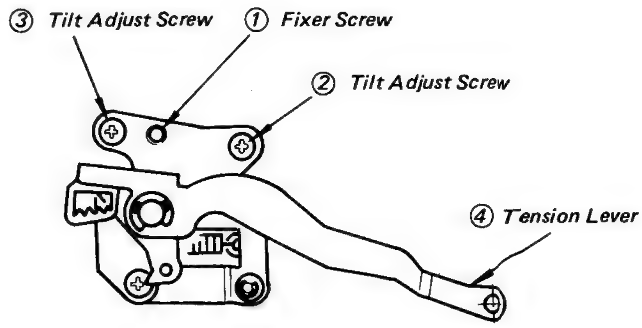


Fig. 5-120 Adjustment of the Tilt Screw

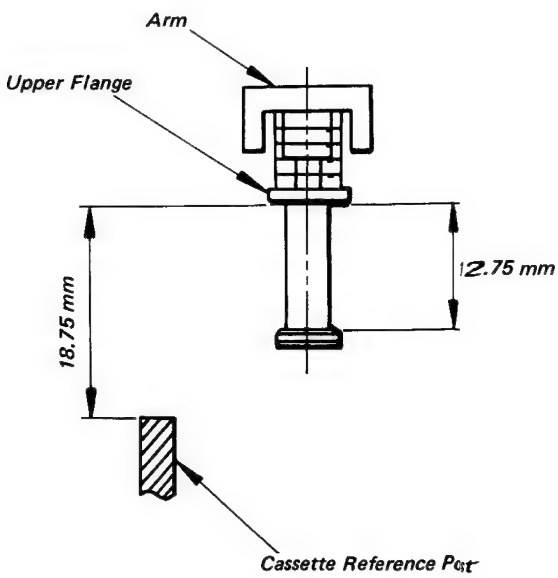


Fig. 5-121 Adjustment of O Guide Height

C. Adjust the height of 1st ③ and 2nd ④ guides to maintain that the clearance between the guide upper plates and the tape upper portion is 0.5 mm approximately (see Fig. 5-115) and confirm that there is no cross portion in the envelope (see Fig. 5-122).
If there is the cross portion in the envelope, adjust the screw ③ as shown in Fig. 5-120 by a half quarter turn to eliminate it.

NOTE: Do not turn the screw ③ more than 90 degrees.

D. Adjust the O guide to maintain that the cross portion in the envelope should be appeared (Fig. 5-123) one or a half and adjust the entrance guides as shown Section 34-1 step 5-a.

34-4. Tracking Adjustment After Replacement of the Exit Guide Assembly

1. Playback the monochrome section of alignment tape.
2. Adjust the exit guides to maintain that the level of envelope is obtained flatly as shown Section 34-2 step 5-b.
3. If the tape has the curl or wrinkle at the exit side, or the envelope level is not flat, needed the following adjustment:
   a. Adjust the clearance between the upper flanges and the tape upper portion is 0.5 mm approximately. (Fig. 5-126).
   b. Confirm whether the level of envelope becomes flat when pressing or lifting the tape by the finger.
   c. Adjust the tilt adjustment screw ⓔ as shown in Fig. 5-124 to obtain the envelope as shown in Fig. 5-125.
   d. After adjusted tilt adjustment screw ⓔ, needed the exit guide adjustment as shown in Section 34-2 step 5-b.

CAUTIONS:
1. When turning the tilt adjustment screw ⓔ clockwise, the tape transportation should be down.
   When turning the tilt adjustment screw ⓔ counter-clockwise, the tape transportation should be upward.
2. The tilt adjustment screw ⓔ should be adjusted by a half quarter turn since the audio/control head assembly is adjusted critically in the vertical angle.
3. Do not tighten the 4th guide ⑥ too much since the audio level should be varied easily. (see Fig. 5-116)

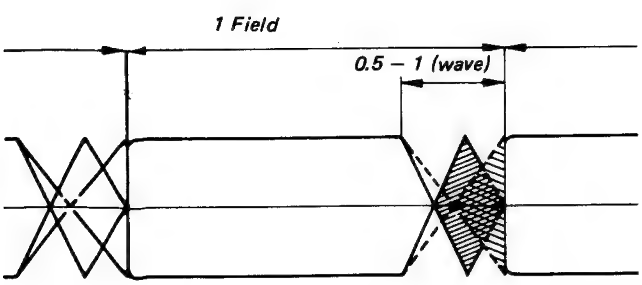


Fig. 5-125 Exit Side Envelope Wave-form

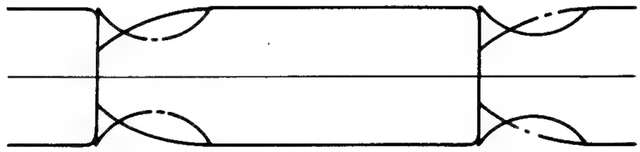


Fig. 5-122 Entrance Side Envelope Wave-form

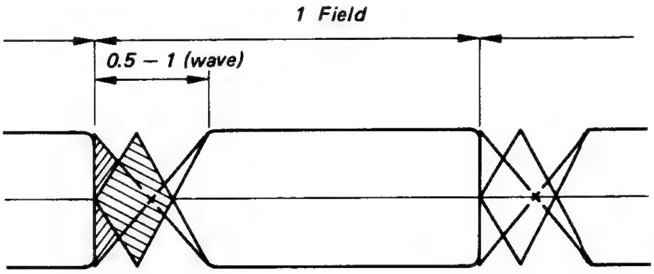


Fig. 5-123 Entrance Side Envelope Wave-form

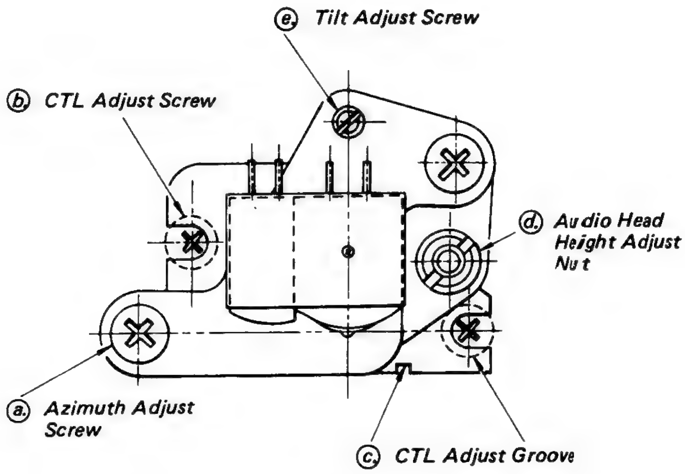


Fig. 5-124 Adjustment Screws of Audio Control Head Assembly

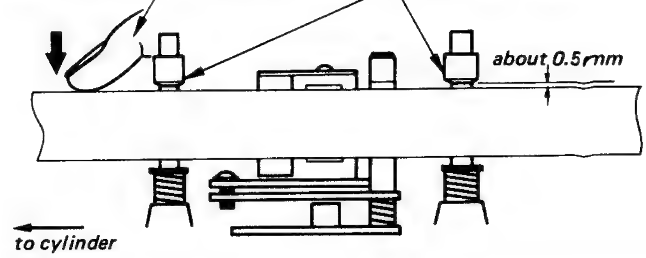


Fig. 5-126 Method to Adjust Exit Tape Path

34-5. Audio Azimuth Adjustment

1. Connect the VTVM to the AUDIO OUT terminal (see Fig. 5-127).
2. Playback the RF sweep section (5 kHz) of alignment tape.
3. Adjust to obtain the maximum aduio level by rotation the audio azimuth adjustment screw (see Figs. 5-124, 5-127).

34-6. Audio/Control Head Height Adjustment

1. Playback the monoscope section (333 Hz) of alignment tape.
2. Adjust the nut ⓓ to obtain the maximum level of the audio by a half quarter turn (see Fig. 5-128).
3. Confirm if the variation of the Audio level is limited within 2 dB. (Fig. 5-127)

34-7. CTL Position Adjustment (see Fig. 5-128)

CAUTIONS: Before this adjustment.
Make sure the tracking center alignment described on page 122 item 2.

1. Playback monochrome signal from alignment test tape.
2. Set the tracking control knob untill the phase difference between the trailing edge of the pulse at TP501 and the leading edge of the pulse at TP502 is 0 msec.
3. Loosen the two screws ⓑ for the CTL adjustment and adjust the position of the CTL head with flat screwdriver so that the RF output of TP101 on the printed circuit board reaches its maximum output.
4. Verify that the Audio/CTL head is positioned at about the center of the notch in the guide base.
5. Retighten the two screws ⓑ for the CTL adjustment.

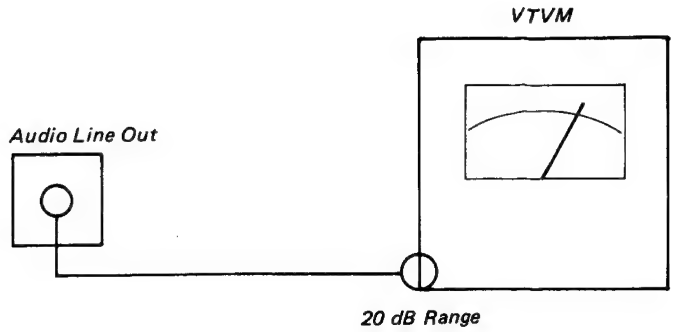


Fig. 5-127 Audio Output Level

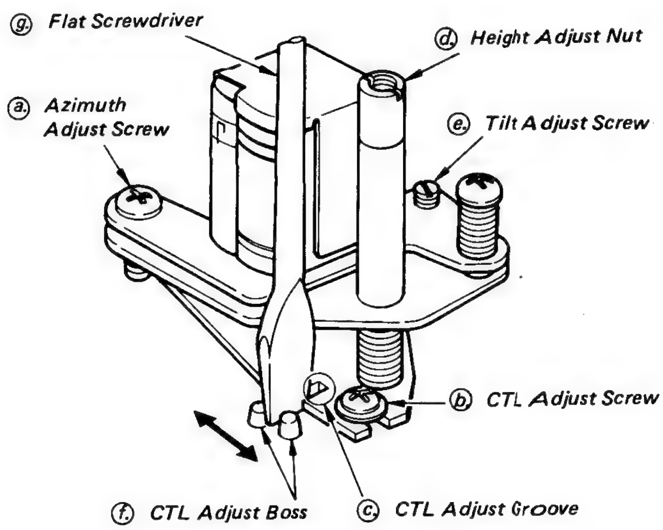


Fig. 5-128 CTL Adjustment

35. Maintenance

4-1 PERIODIC INSPECTION AND MAINTENANCE

Maintenance Items and Period

The V-8600B should be maintained for best performance at all times in accordance with the table below.

NOTE: -For cleaning, use isopropyl alcohol.

ITEM \ PERIOD (HOURS)	500	1000	1500	2000	2500	3000	3500	4000	5000	40000
Video head disk assembly	▽	▽	▽	▽	▽	▽ ○	▽	▽ ○	▽ ○	
Audio and control head assembly	▽	▽	▽	▽	▽	▽ ○	▽	▽	▽	
Capstan assembly		▽ ▲		▽ ▲		▽ ▲	▽ ○ ▲		▽ ▲	
Capstan bearing assembly		▽ ▲		▽ ▲		▽ ▲		▽ ○ ▲	▽ ▲	
Pinch roller	▽	▽		▽		▽ ○		▽	▽	
Dew sensor element				▽				▽		
Reel belt								○		
Capstan belt								○		
Play belt								○		
Tape-Up belt										○
Counter belt								○		
Supply reel table assembly				▽ ▲				▽ ▲		
Take-up reel table assembly				▽ ▲				▽ ▲		
Play idler assembly				▽				▽		
Fast-forward gear assembly									○	
Rewind gear assembly				▲				▲	○	
Guide pulley assembly				▽ ▲				▽ ▲		
Band brake assembly								○		
Planet gear unit assembly				▽ ▲				▽ ▲		
Disk motor									○	
Tape guide and the like	▽	▽	▽	▽	▽	▽	▽	▽	▽	
Capstan motor										
Loading drive assembly				▽ ▲				▽ ▲	○	
Unloading tire assembly				▽ ▲				▽ ▲	○	
Damper assembly									▲	
Loading belt										○

NOTE: -○ indicates replacement, ▲ lubrication, and ▽ cleaning.
For replacement, refer to the "Service Bulletin"

CAUTION: -For lubrication, the Toshiba's LK-100 Lubrication Kit should be used.
Never apply excess oil to any part as it would be splashed by part revolution, causing maloperation.

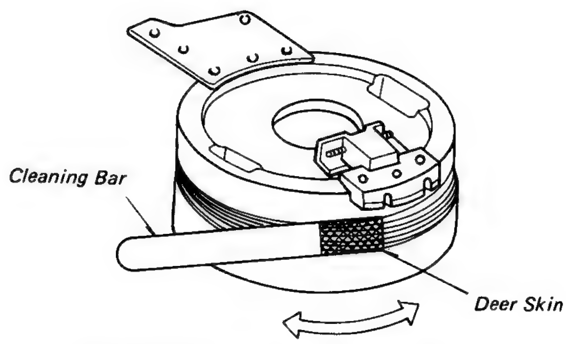


Fig. 5-129 Video Heads Cleaning

Cleaning the Video Heads

To clean the video heads, wipe them with a cleaning bar of deer skin moistened in isopropyl alcohol.

CAUTION: -Never leave the video heads revolving during cleaning or they could be damaged.
The heads and cylinder should be cleaned by lightly wiping the cleaning bar right and left on the furface as shown in Fig. 5-129.

Cleaning the Audio and Control Head and Full Width Erase Head

To clean the audio and control heads and full width erase head, wipe the cleaning head right and left on the surface as shown in Fig. 5-130.

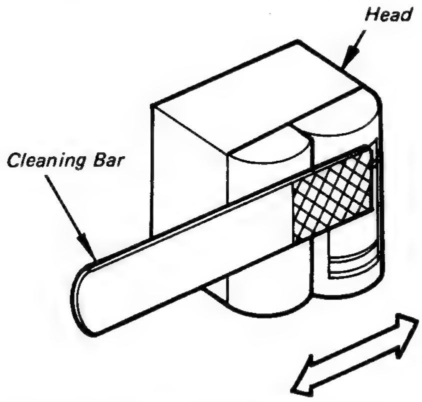


Fig. 5-130 Audio and Control Heads and Full Width Erase Head Cleaning

Cleaning the Capstan Assembly and Capstan Bearing Assembly

To clean these assemblies, first remove the cabinet as directed in Section 5-3-1, the "Removing the Cabinet". Remove the two screws holding the Video Circuit board and Servo Logic circuit board located on the bottom of the VTR body. Take out the board. Now, clean the assemblies. PW board. Now, clean the assemblies.

Cleaning the Belts, Idlers, and Pulleys

To clean these parts, use a cleaning rod having cotton at each end or a cloth moistened a little in isopropyl alcohol. (see Fig. 5-131)

CAUTION 1:- Disconnect all power from the VTR before cleaning any parts.

2:- Each flat belt should be installed with the white mark facing outside and the arrow indicating the revolutional direction as shown in Fig. 5-132.
The square belts should not be twisted. (see Fig. 5-133)

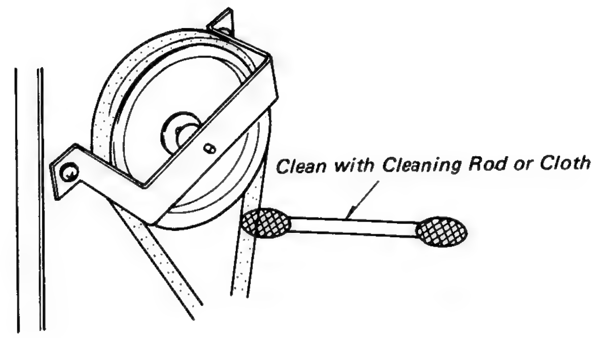


Fig. 5-131 Cleaning the Belts, Idlers, and Pulleys

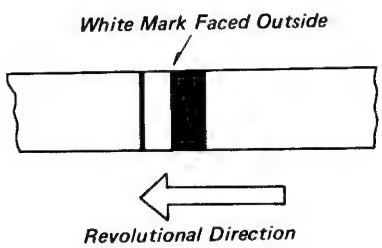


Fig. 5-132 Flat Belt

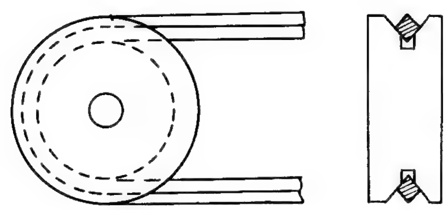
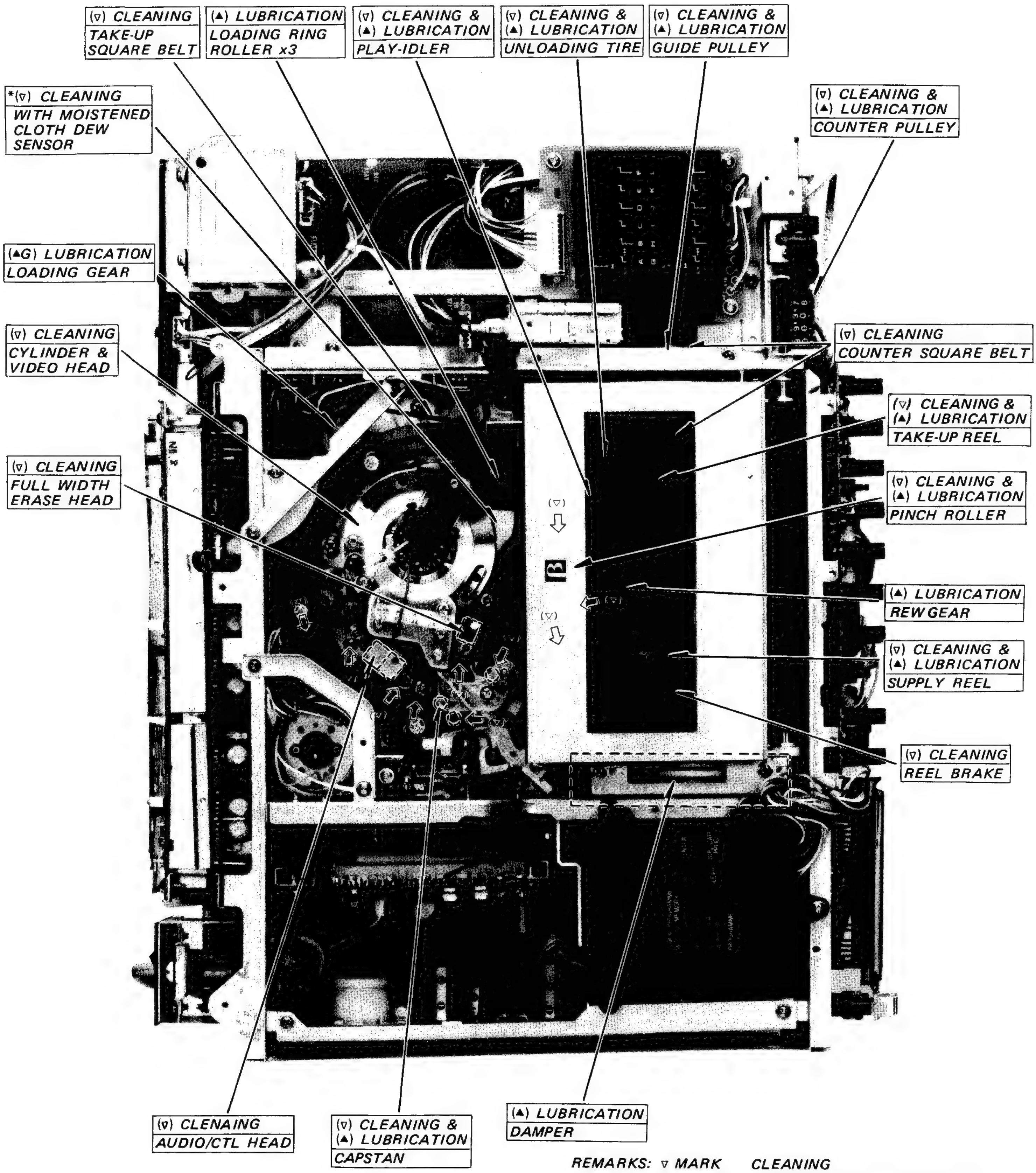


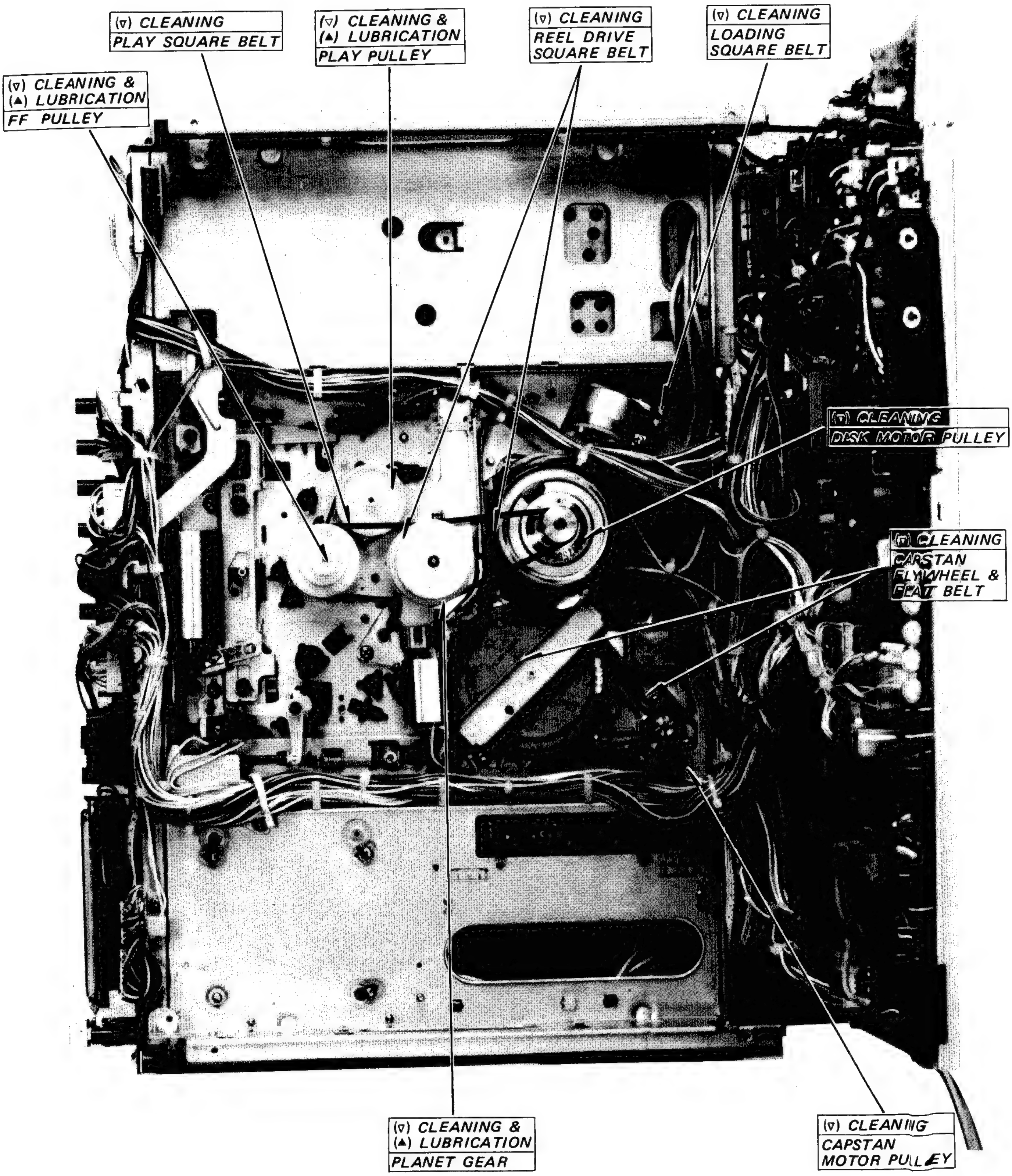
Fig. 5-133 Square Belt

4-1-6 Parts to be Cleaned on Top of Chassis



REMARKS: ▽ MARK CLEANING
▲ MARK LUBRICATION (OIL SPECIFIED)
▲ G MARK GREASING
NOTE 1 * MARK CLEANING WITH SLIGHTLY MOISTENED CLOTH
NOTE 2 ⇨ MARK CLEANING OF TAPE GUIDE

5-1-7 Parts to be Cleaned on Bottom of Chassis



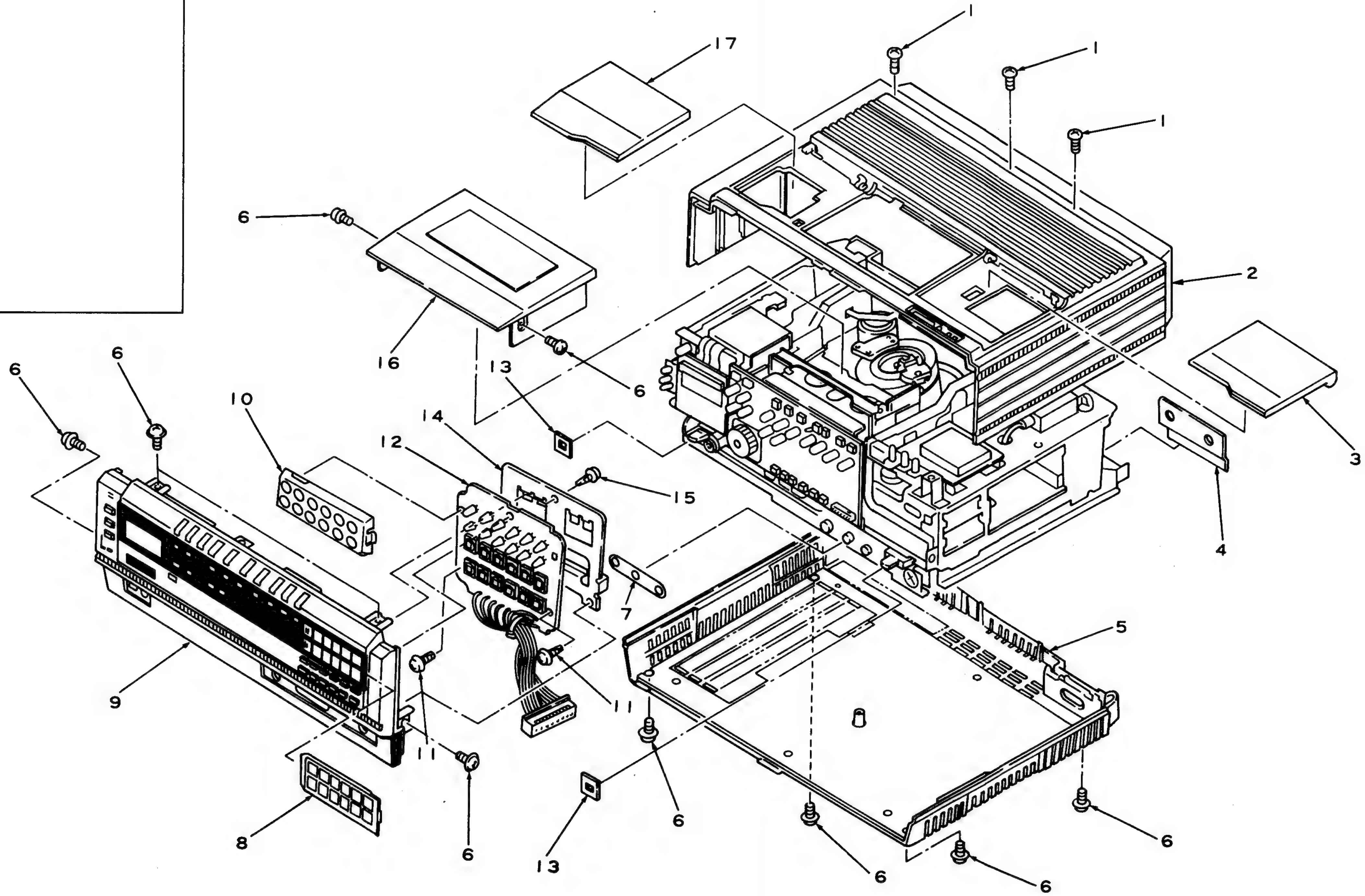
REMARKS: ▽ MARK CLEANING
▲ MARK LUBRICATION (OIL SPECIFIED)

SECTION 6 EXPLODED VIEWS

1. CABINET ASSEMBLY

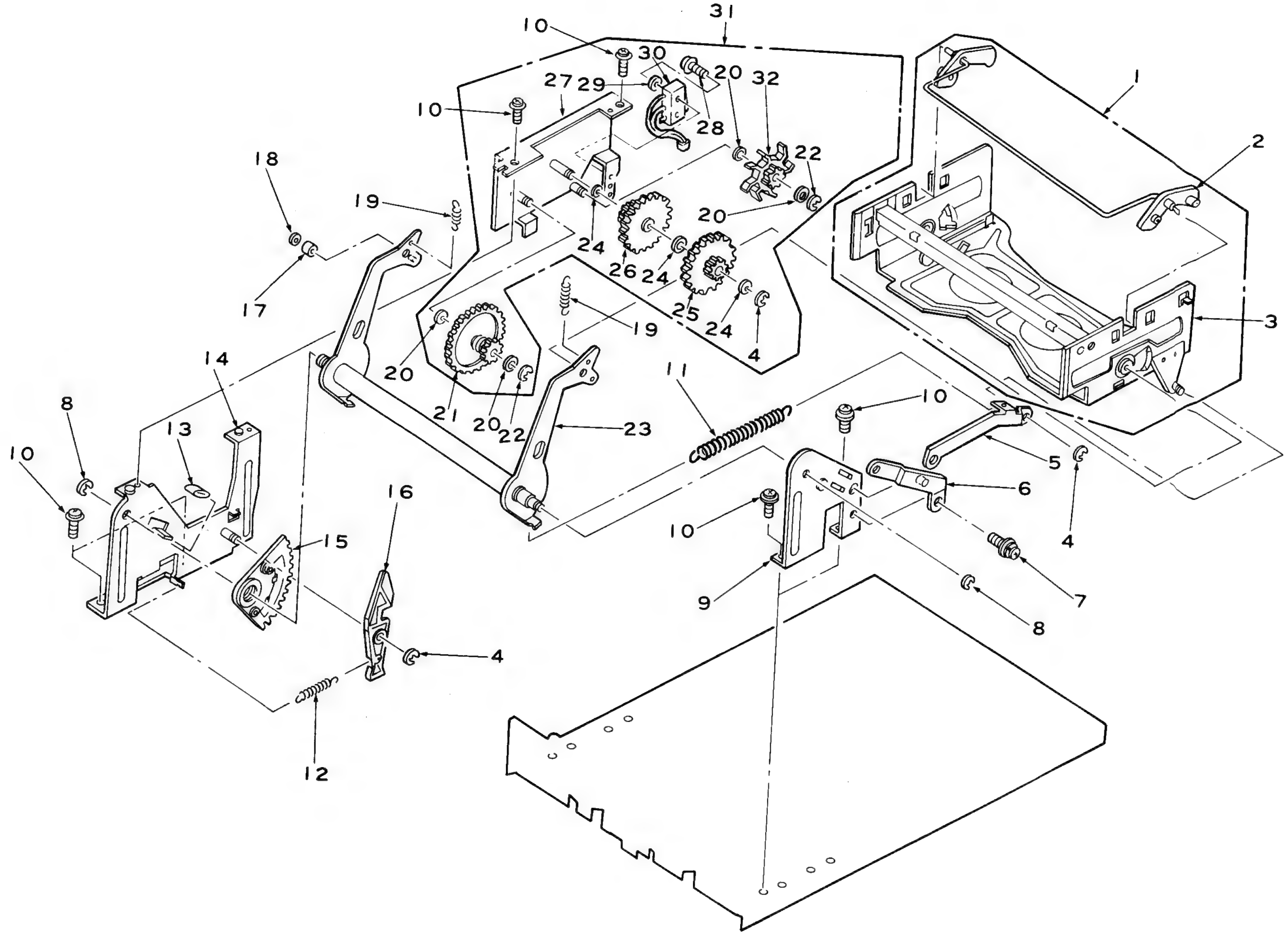
Key Number	Location Number	Part Number	Description	Remarks
1	A102E		Screw, Decoration	
2	A102	70814149	Top Cover	
3	A102A	70863017	Door (R)	
4	A107	70810054	Back Cover, Jack	
5	A103	70815038	Bottom Cover	
6	A103A		Screw, 3 x 6 MM	
7	A106	70810053	Front Cover, Jack	
8	A101F		Channel Tab Holder	
9	A101	70812175	Front Panel	
10	VA01		Holder, LED	
11	VA03		Screw, 3 x 8 MM	
12	UA01		PC Board Ass'y, Key Board	
13	A109	70810056	Cover, Slide Switch	
14	VA02		Bracket, LED	
15	A114		Screw, 4 x 10 MM	
16	A104	70819023	Cassette Cover	
17	A102B	70863005	Door (L)	

CAUTION
Part without part number is not SERVICE parts.
For Electrical parts, refer to Electrical parts list.



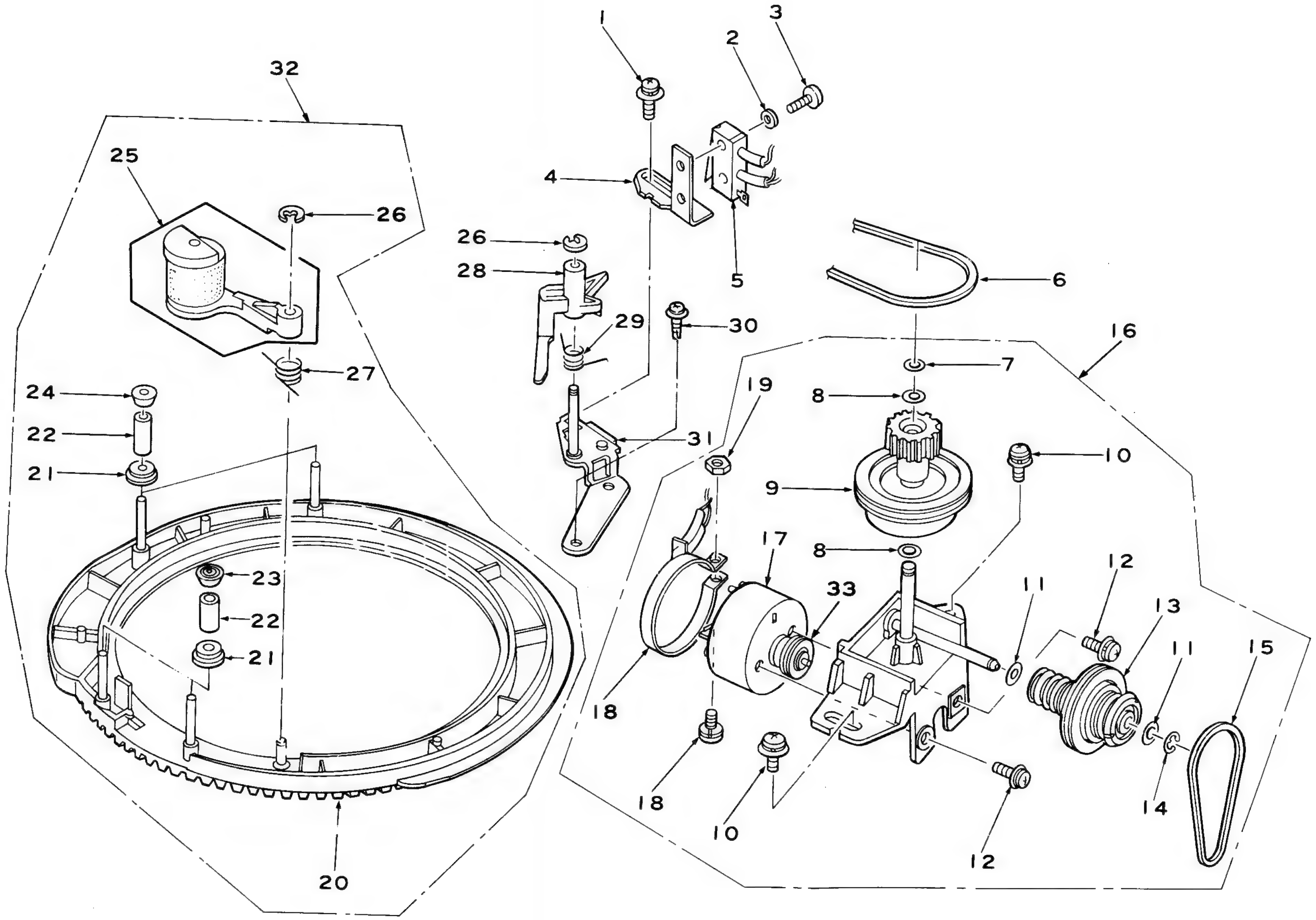
2. CASSETTE COMPARTMENT ASSEMBLY

Key Number	Location Number	Part Number	Description	Remarks
1	K301		Cassette Compartment Ass'y	
2	K305		Bracket	
3	K302		Bracket	
4	K307		E Ring, 3 MM	
5	K320		Link	
6	K318		Bracket, Link Adjust Ass'y	
7	K319		Screw, 3 x 6 MM	
8	K327	23002400	E Ring, 4 MM	
9	K317		Bracket, Lifter	
10	K328		Screw, 3 x 6 MM	
11	K321	70351368	Spring, Lifter	
12	K315	70351367	Spring, Locker	
13	K316	70354022	Cushion	
14	K312		Bracket, Lifter (Left)	
15	K324	70333035	Gear, Cassette Lifter	
16	K313	70324146	Locker	
17	K322E		Roller, Bracket	
18	K322F		Washer, Polyethylene 2 x 4 x 0.25 MM	
19	K323	70351385	Spring, Cassette Compartment	
20	K357		Washer, Thrust	
21	K354	70324163	Clutch Ass'y	
22	K359	23002200	E Ring, 2 MM	
23	K322		Bracket, Lifter Sub Ass'y	
24	K358		Washer, Polyethylene, 4.1 x 6.5 x 0.5 MM	
25	K353	70333036	Gear, Damper	
26	K355	70333039	Gear, Idler	
27	K352		Bracket, Damper	
28	S651A		Screw, 2.3 x 10 MM	
29	S651B		Washer, 2.3 MM	
30	S651	70145133	Switch, Push	
31	K351	70324174	Damper Ass'y	
32	K356	70333040	Gear, Soft EJECT	



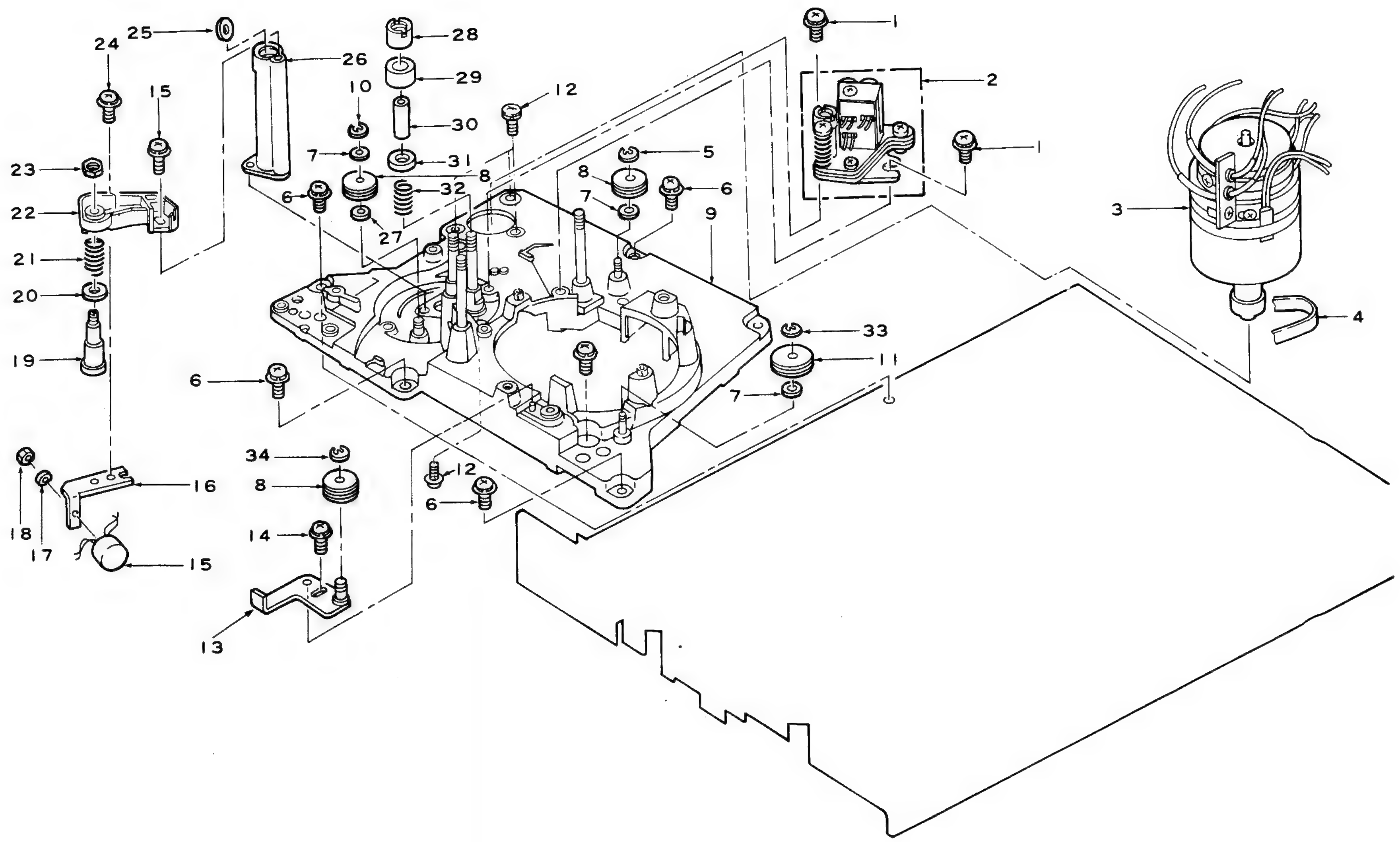
3. MAIN BASE ASSEMBLY (1)

Key Number	Location Number	Part Number	Description	Remarks
1	S652D		Screw, 3 x 6 MM	
2	S652C		Washer, 2.3 MM	
3	S652B		Screw, 2.3 x 10 MM	
4	S652A		Bracket, Detect Switch	
5	S652	70145133	Switch, Push	
6	K624	70342079	Belt, Square, Take-Up	
7	B505		Washer, Polyslider	
8	B504	70396008	Washer, 3.1 MM Polyethylene	
9	B503		Loading Gear Ass'y	
10	B551		Screw, 3 x 8 MM	
11	B507		Washer, 3.1 MM Polyethylene	
12	B510		Screw, 2.6 x 6 MM	
13	B506		Worm Clutch Ass'y	
14	B508	23002150	E Ring, 1.5 MM	
15	B511	70342083	Belt Square, Loading	
16	B502		Loading Drive Ass'y	
17	M003	70125054	Motor Ass'y, Loading	
18	B521	70312047	Shield Ass'y	
19	B527		Nut, 3 MM	
20	B401		Loading Disk	
21	B402		Base, Roller	
22	B403	70322129	Roller	
23	B404		Return Pole Cap	
24	B405		Roller Pole Cap	
25	B406	70322134	Lever Ass'y, Pinch Roller	
26	B407	23002200	E Washer	
27	B408	70351263	Spring, Pinch Roller	
28	B251	70321287	Lever, Loading End Detector	
29	B241	70351307	Spring, Detect Lever	
30	B232		Screw, 3 x 8 MM, Tapping	
31	B231		Detect Lever Ass'y	
32	B044	70312049	Loading Ring Ass'y	
33	B509	70312046	Motor Ass'y with Pulley	



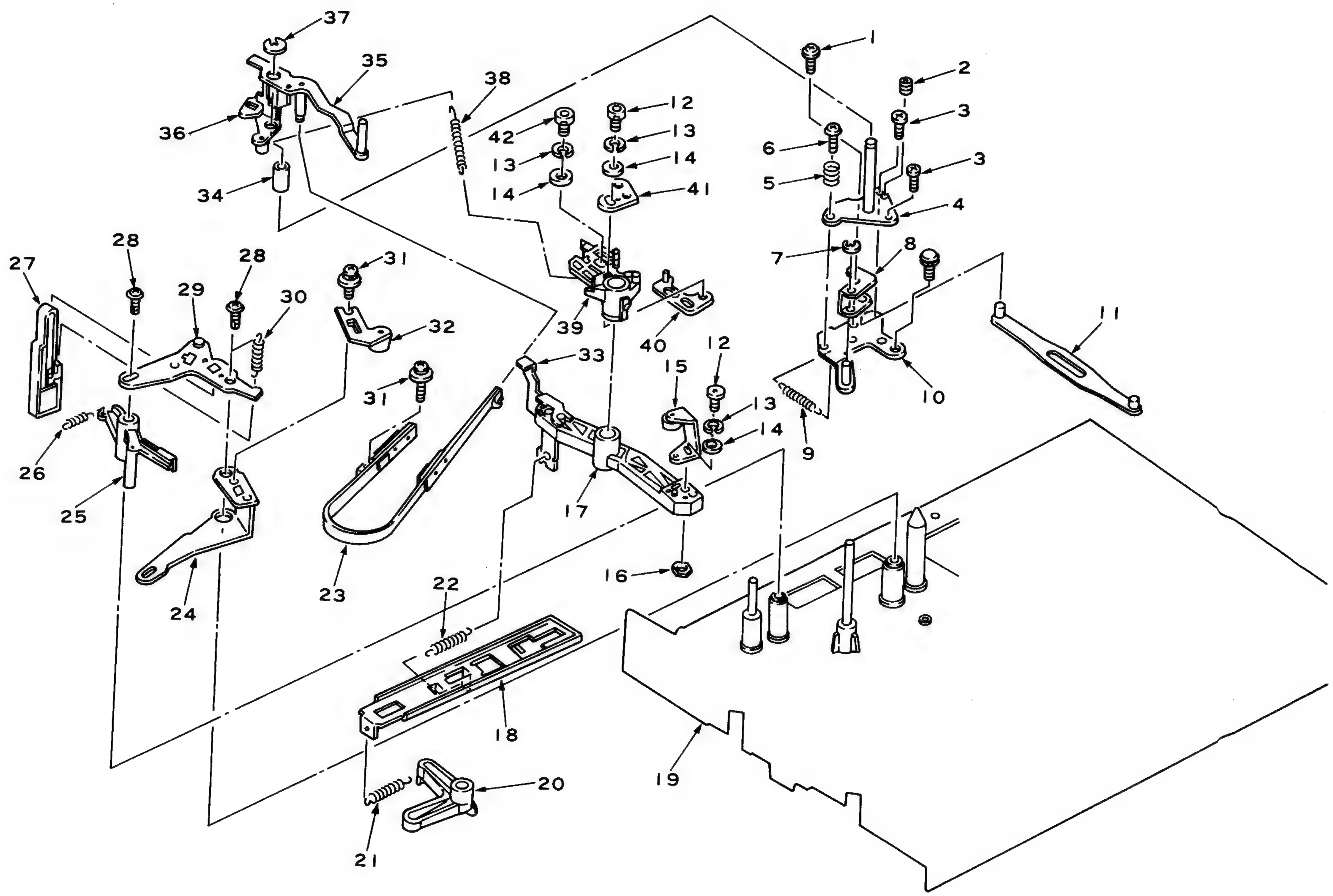
4. MAIN BASE ASSEMBLY (2)

Key Number	Location Number	Part Number	Description	Remarks
1	G210		Screw, 3 x 10 MM	
2	G202	70311082	Guide Ass'y, Exit	
3	M002E	70125074	Motor Ass'y, Capstan	
4	B307	70342093	Belt, Flat, Capstan	
5	B215	70394070	E Ring	
6	G002A		Screw, 3 x 12 MM	
7	B212		Washer, Thrust	
8	B211	70348044	Roller, Disk Guide	
9	G002		Main Base	
10	B223	23002200	E Washer	
11	B221	70341266	Pulley, Relay	
12	M002A		Screw, 3 x 6 MM	
13	B201A		Disk Guide Roller Ass'y	
14	B202		Screw, 3 x 8 MM	
15	L662		Sensing Coil 0.18 MHZ	
16	G229K		Holder, Sensing Coil	
17	L662B		Washer, 2 MM	
18	L662A		Nut, 2 MM	
19	G229B		Shaft Ass'y, First Guide	
20	G229F		Flange, First Guide, Upper	
21	G229G	70351374	Spring, First Guide Adjust	
22	G229A		Arm, First Guide	
23	G229H		Nut, 3 MM	
24	G229L		Screw, 3 x 5 MM	
25	B308	70328104	Oil Reservoir	
26	G235		Sleeve Ass'y, Capstan	
27	B216	70396008	Washer, 3.1 MM Polyethylene	
28	G227		Nut, B	
29	G231		Flange, Exit Guide, Upper	
30	G221		Guide Pole, Entrance	
31	G232		Flange, Exit Guide, Lower	
32	G228		Spring, Tape Exit Guide	
33	B213	23002200	E Washer	
34	B201E	23002200	E Washer	



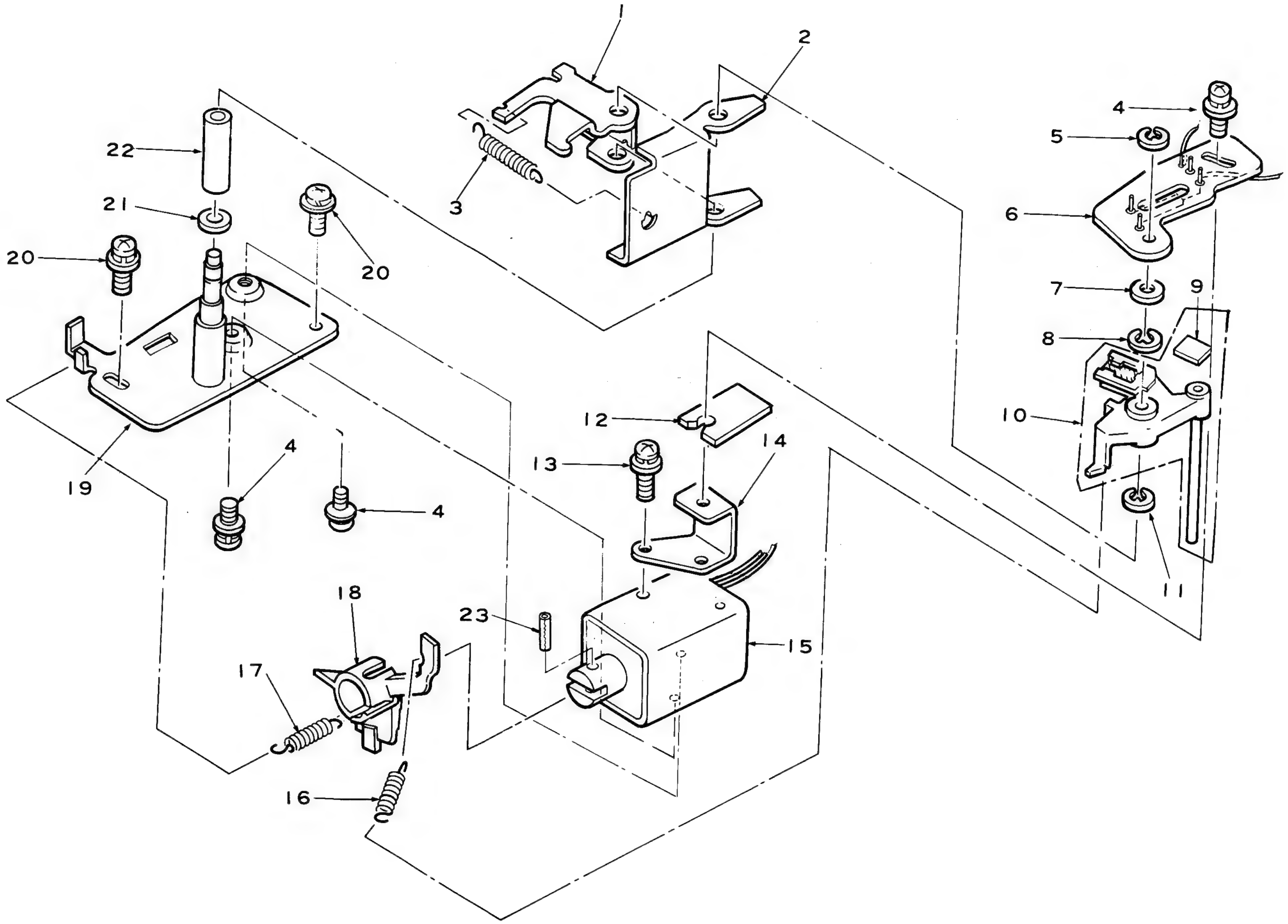
5. REEL AND MAIN CHASSIS ASSEMBLY (1)

Key Number	Location Number	Part Number	Description	Remarks
1	K005A		Screw, 3 x 8 MM	
2	K513		Screw, 3 x 4 MM	
3	K506		Screw, 3 x 0.5 x 6 MM	
4	K505		Post, Ass'y, Tension Lever	
5	K507	70351378	Spring, Adjust	
6	K508		Screw, 3 x 0.5 x 12 SZN	
7	K503		E Ring	
8	K502		Shift Lever	
9	K504	70351377	Spring Shift	
10	K501		Base Ass'y, Tension Lever	
11	K618		Link Ass'y	
12	K601A		Screw, 3 x 8 MM	
13	K601B		Washer	
14	K601C		Washer	
15	K603		Detect Plate Ass'y	
16	K601D		Nut, 3 x 0.5 MM	
17	K601	70326440	Detect Lever Ass'y	
18	K219		Slider, Lock Release	
19	K101		REEL Drive Chassis Ass'y	
20	K220	70326378	Lever, Release	
21	K221	70351395	Spring, Lock Release	
22	K604	70351373	Spring, Detector	
23	K619	70326399	Brake Ass'y, Band	
24	K138		Lever, Cam Follower	
25	K141	70326338	Lever Ass'y, FF Brake	
26	K142	70351394	Spring, FF Brake	
27	K143	70326375	Bracket, Cassette Detect Lever	
28	K146		Screw, 3 x 10 MM Tapping	
29	K145		Bracket, Cassette Detector	
30	K144	70351371	Spring, Cassette Detector	
31	K140		Screw, 3 x 6 MM	
32	K139B	70348056	Roller, Cam Follower	
33	K605	70326438	Detect Sub Lever	
34	K509	70394068	Spacer	
35	K510	70328261	Lever Ass'y, Tension	
36	K512		Holder, Tension Spring	
37	K511		E Ring, 4 MM	
38	K617	70351386	Spring, Tension	
39	K607	70326390	Guide Lever	
40	K613		Stop Lever Ass'y	
41	K608		Cam Follower Ass'y	
42	K614		Screw, 3 x 6 MM	



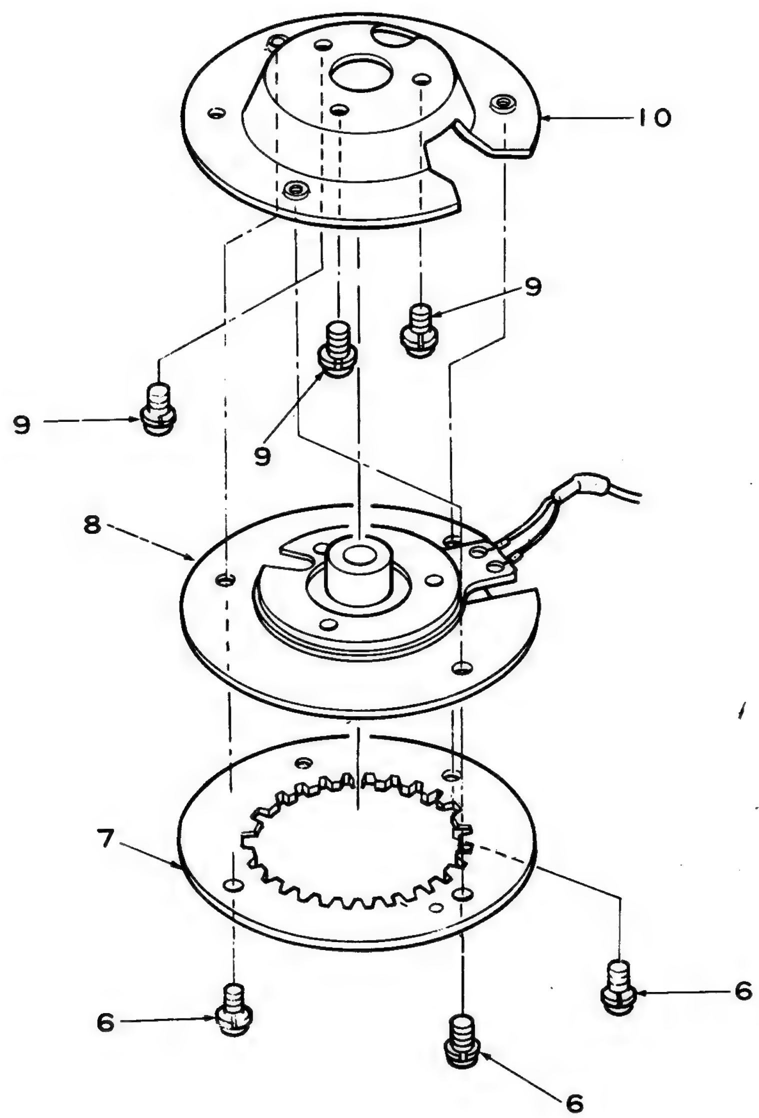
6. REEL AND MAIN CHASSIS ASSEMBLY (2)

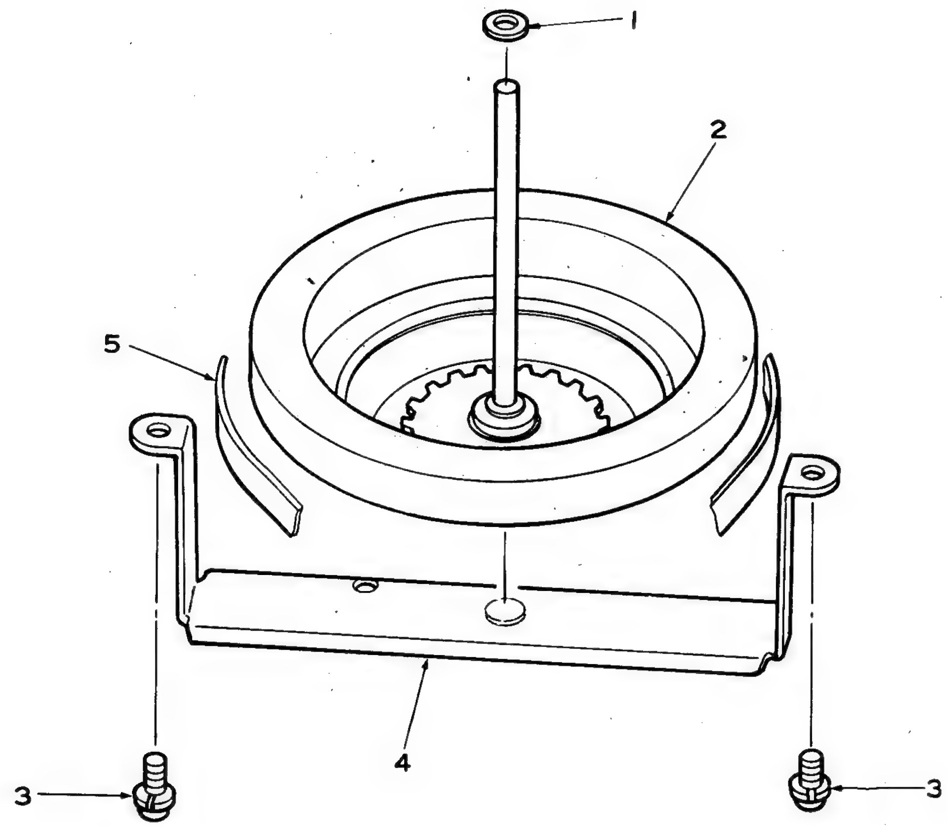
Key Number	Location Number	Part Number	Description	Remarks
1	B104		Pinch Lock Arm	
2	B105		Pinch Lock Bracket	
3	B107		Spring, Pinch Lock	
4	U591A		Screw, 3 x 6 MM	
5	U591B		E Ring	
6	U591		PC BOARD Ass'y, Slack	
7	B119		Washer, Polyslider	
8	B109	23002200	E Washer	
9	B108B		Magnet, Slack Lever	
10	B108	70321254	Lever Ass'y, Tape Slack	
11	B106		E Ring, 3 MM	
12	B120	70394063	Washer, Slack Adjustment 1.0 MM	
	B120	70394062	Washer, Slack Adjustment, 0.5 MM	
13	B115		Screw, 3 x 5 MM	
14	B114		Holder, Slack, Board	
15	L651		Solenoid, Pinch Lock	
16	B113	70351297	Spring, Slack Lever	
17	B112	70351380	Spring, Pinch Release	
18	B110		Pinch Cap	
19	B101		Bracket, Pinch Fixing Plate Ass'y	
20	B151		Screw, 3 x 8 MM	
21	B102		Washer	
22	B103		Spacer	
23	B111	70328227	Spring Pin	



7. REEL AND MAIN CHASSIS ASSEMBLY (3)

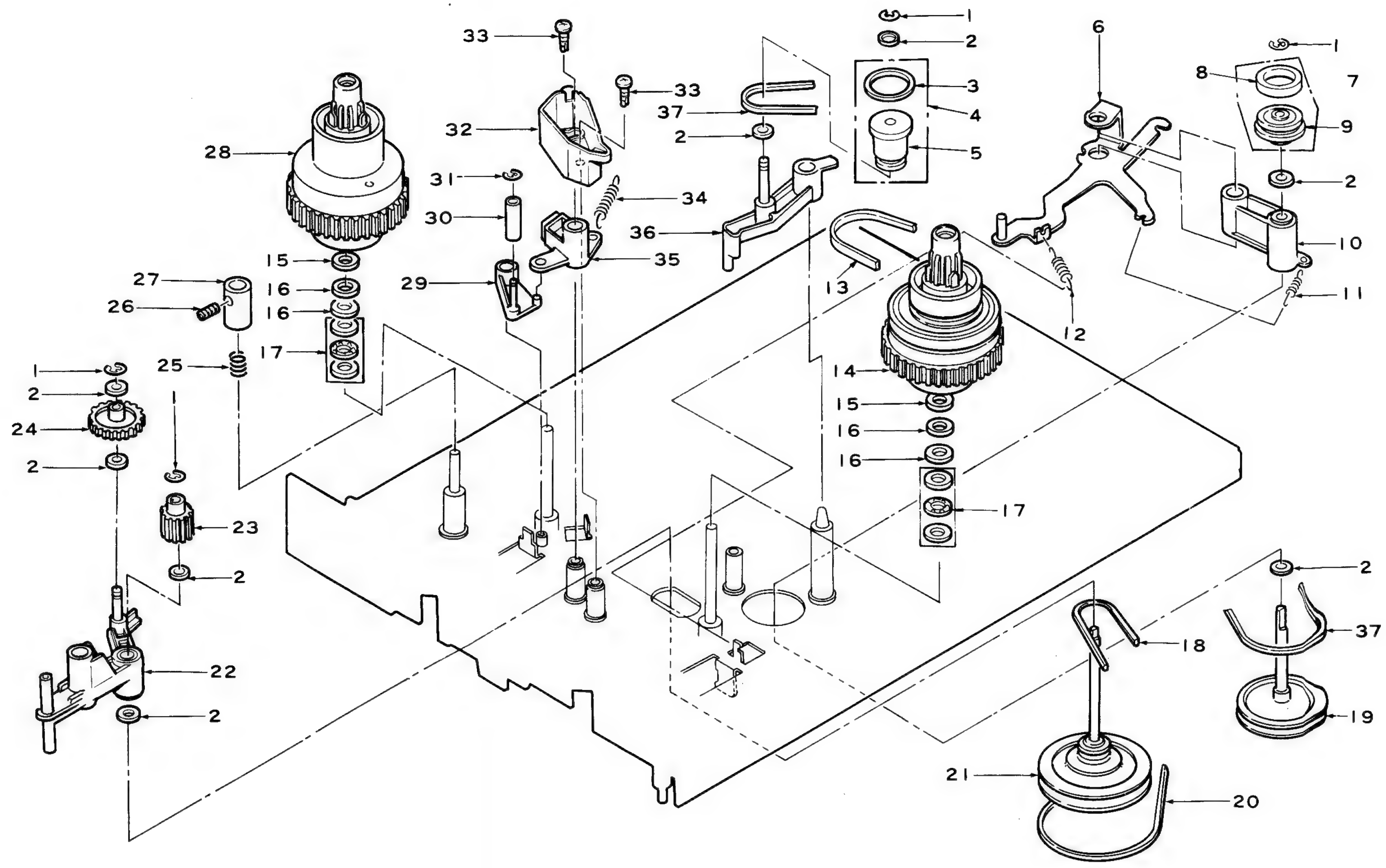
Key Number	Location Number	Part Number	Description	Remarks
1	B305D	70394018	Slider, Polyethylene, 3 x 7 x 0.25 MM	
2	B305	70335021	Flywheel Ass'y, Capstan	
3	B306A		Screw, 3 x 8 MM	
4	B306		Bearing Bracket Ass'y	
5	B307	70342093	Belt, Flat, Capstan	
6	B304A		Screw, 2.6 x 6 MM	
7	B304		Tac Plate A	
8	B301	70321361	Coil Ass'y, FG Pulse	
9	G236A		Screw, 3 x 8 MM	
10	G236		Bracket, Capstan FG	





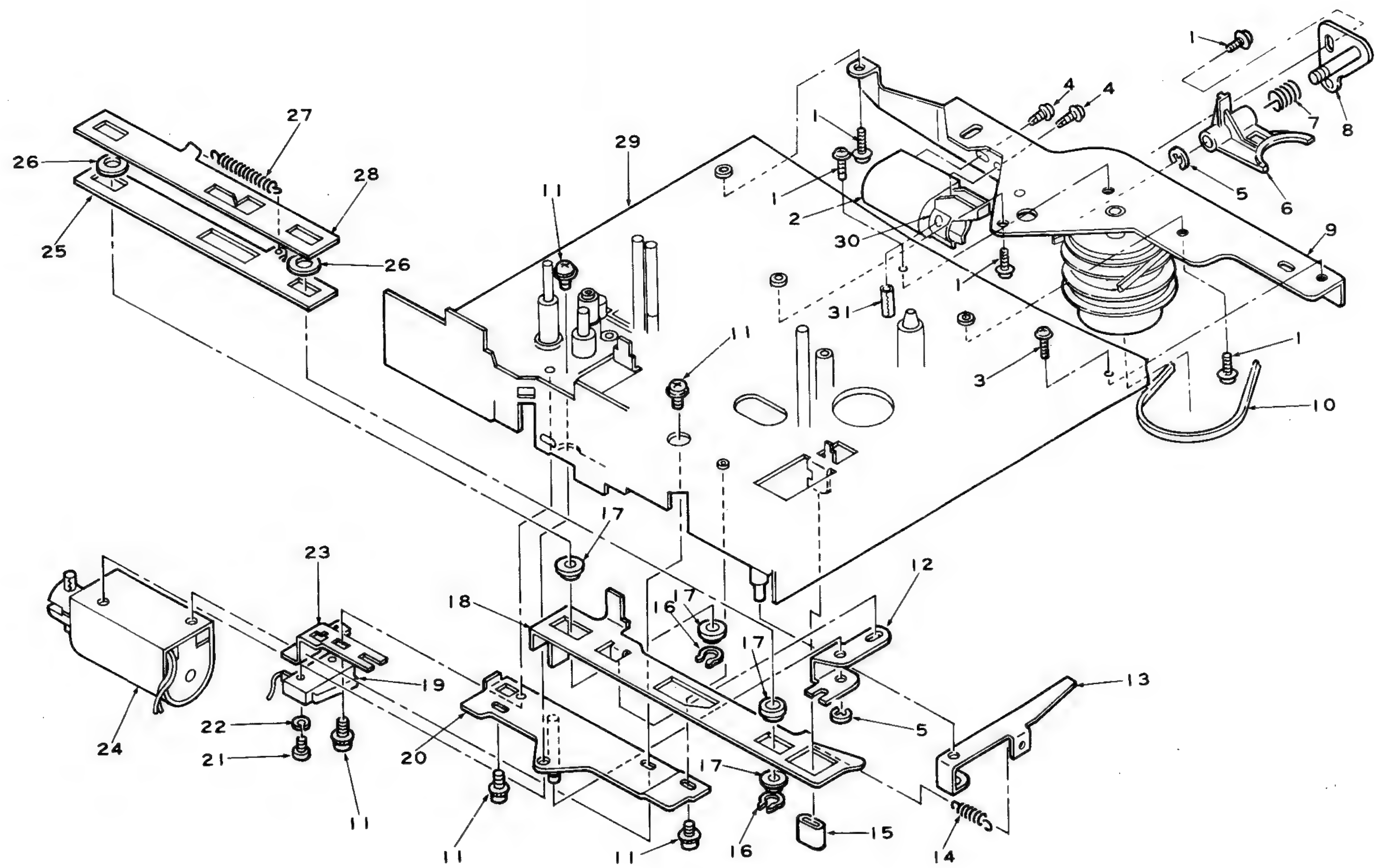
8. REEL CHASSIS ASSEMBLY (1)

Key Number	Location Number	Part Number	Description	Remarks
1	K128	23002200	E Washer	
2	K127		Washer, Thrust	
3	K126B		Tire, Unloading	
4	K126	70326328	Tire Ass'y, Unloading	
5	K126A		Wheel, Unloading	
6	K116	70326322	Lever Ass'y, Playback	
7	K122	70326321	Idler Ass'y, Playback	
8	K122B	70331069	Tire	
9	K122A		Wheel	
10	K118	70326317	Lever Ass'y, Playback	
11	K119	70351357	Spring, Playback Lever	
12	K117	70351366	Spring, Slider Release	
13	K625	70342078	Belt, Square, Counter	
14	K192	70327032	Reel Table Ass'y, Take-Up	
15	K197		Washer, 4 x 9 x 0.1 MM	
16	K194	70394048	Washer, Reel Table	
17	K193	70348028	Bearing, Thrust	
18	K124	70342076	Belt, Square, Playback	
19	K120	70326319	Pulley Ass'y, Playback Playback	
20	K232	70342077	Belt, Square, Reel	
21	K112	70326311	Clutch Ass'y, FF	
22	K108	70326308	Lever Ass'y, Forward/Reverse	
23	K114	70333028	Gear, FF	
24	K109	70333027	Gear, Rewind	
25	K102		Spring, Cassette Lever	
26	K104		Screw, 3 x 4 MM	
27	K103	70326388	Nut, Cassette Height Adjust	
28	K191	70327036	Reel Table Ass'y Supply	
29	K129	70326331	Lever Ass'y, Supply Brake Shift	
30	K134		Roller, Brake	
31	K135	23002150	E Ring	
32	K131		Lever Holder, FF/REW	
33	K132		Screw, 3 x 10 MM, Tapping	
34	K137		Spring, Brake	
35	K130	70326329	Lever Ass'y, Supply Brake	
36	K125	70326325	Lever Ass'y, Unloading	
37	K624	70342079	Belt, Square, Take-Up	



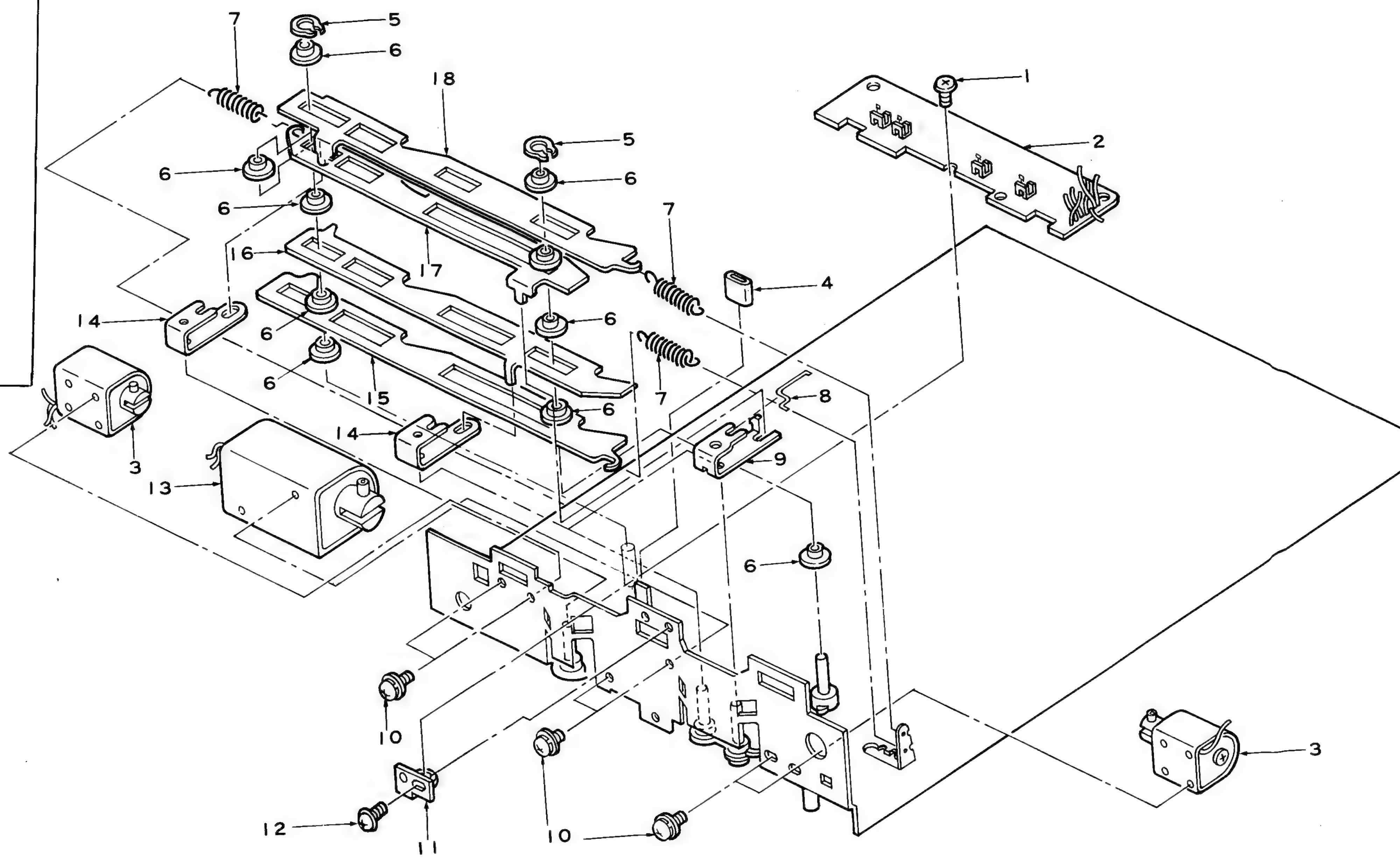
9. REEL CHASSIS ASSEMBLY (2)

Key Number	Location Number	Part Number	Description	Remarks
1	K223		Screw, 3 x 6 MM	
2	L657		Solenoid F/R Search	
3	G002A		Screw, 3 x 12 MM	
4	K230		Screw, 3 x 5 MM	
5	K228		E Ring, 3 MM	
6	K227	70326373	Lever, Lifter	
7	K226	70351384	Spring, Lifter Arm	
8	K224		Holder, Lifter Arm	
9	K222	70326360	Gear Ass'y, Drive	
10	K623	70342077	Belt, Square, Reel	
11	K208		Screw, 3 x 6 MM	
12	K212	70323261	Lever, EJECT, Solenoid	
13	K217		Sub Lever, Unloading	
14	K218	70351361	Spring, Unloading	
15	K105	70354023	Stopper, Slider	
16	K207	23090050	Ring, Grip 5 MM	
17	K206	70323257	Guide, Polyethylene	
18	K205		Slider, EJECT	
19	S655	70145128	Switch, Micro	
20	K209		Bracket Ass'y, EJECT Solenoid	
21	S655A		Screw, 2.3 x 10 MM	
22	S655B		Washer, 2.3 MM	
23	K215		Bracket, EJECT Switch	
24	L653		Solenoid Ass'y, EJECT	
25	K203		Slider, REW, Release	
26	K202		Slider, Polyethylene, 6.2 x 12 x 0.5 MM	
27	K204	70351393	Spring, FF REW Release	
28	K201		Slider, FF Release	
29	K101		REEL Drive Chassis Ass'y	
30	L657A		Solenoid Cap	
31	L657B		Spring Pin	



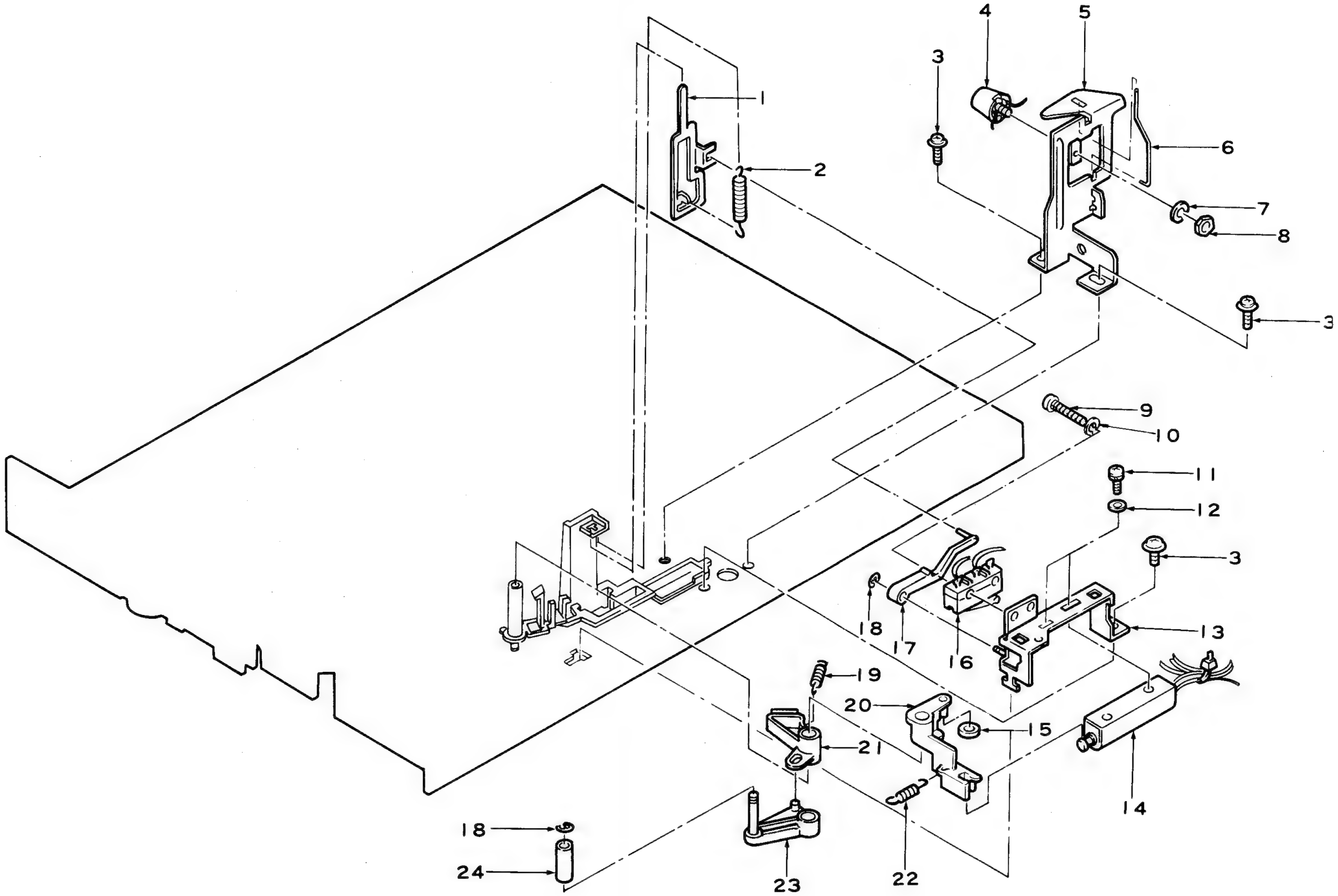
10. REEL CHASSIS ASSEMBLY (3)

Key Number	Location Number	Part Number	Description	Remarks
1	U601A		Screw, 3 x 6 MM	
2	U601		PC BOARD Ass'y, Solenoid Drive	
3	L655		Solenoid Ass'y, FF/REW	
4	K105		Stopper, Slider	
5	K171	23090050	Ring, Grip, 5 MM	
6	K170	70323257	Guide, Polyethylene	
7	K107	70351366	Spring, Slider Release	
8	K196		Spring, Rewind	
9	K195		Lever, REW Solenoid	
10	K164		Screw, 3 x 6 MM	
11	K172		Bracket, Solenoid Drive Unit Holder	
12	K173		Screw, 3 x 6 MM	
13	L652		Solenoid, Playback	
14	K165	70323263	Lever, Solenoid	
15	K166		Slider, Loading	
16	K167		Slider, Play	
17	K168		Slider, Rewind	
18	K169		Slider, FF	



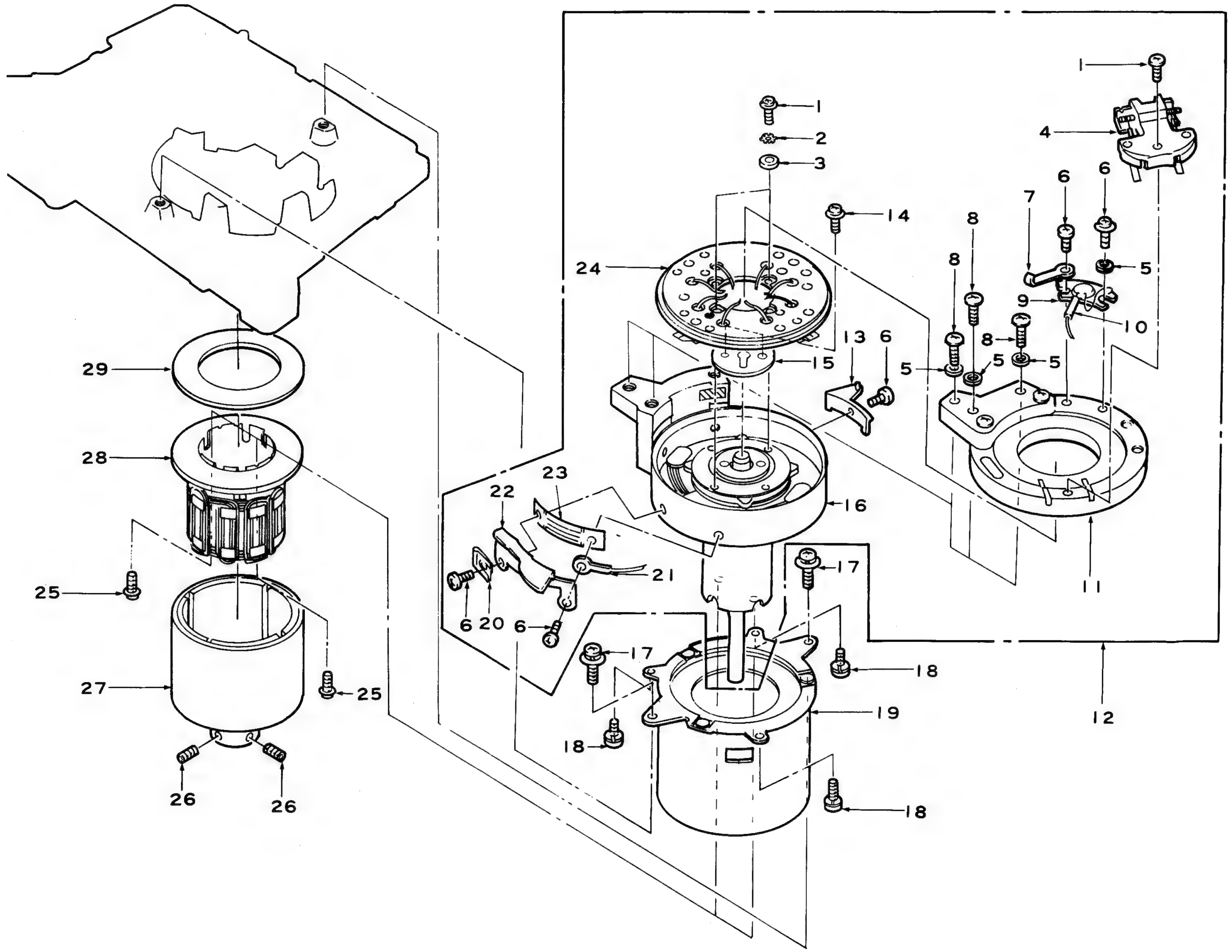
11. REEL CHASSIS ASSEMBLY (4)

Key Number	Location Number	Part Number	Description	Remarks
1	K147	70326354	Slider, Record Safety	
2	K106	70351363	Spring, Record Safety	
3	K157		Screw, 3 x 6 MM	
4	L661		Sensing Coil, 0.18 MHZ	
5	K156		Bracket, Cassette Compartment Opener	
6	K158	70326410	Wire, Insulate	
7	L661B		Washer, 2 MM	
8	L661A		Nut, 2 MM	
9	S653A		Screw, 2.3 x 10 MM	
10	S653B		Washer, 2.3 MM	
11	L656A		Screw, 2.6 x 4 MM	
12	L656B		Washer, 2.6 MM	
13	K149		Bracket Ass'y, Pause Solenoid	
14	L656		Solenoid, Pause	
15	K153B	70353048	Roller, Pause Lever	
16	S653	70145133	Switch, Push	
17	K151	70326353	Lever, Record Safety	
18	K152	23002150	E Ring	
19	K137	70351358	Spring, Brake	
20	K153	70326348	Lever Ass'y, Pause	
21	K136	70326334	Lever Ass'y, Take-Up Brake	
22	K154	70351362	Spring, Pause	
23	K133	70326336	Lever Ass'y, Take-Up Shift	
24	K134	70348055	Roller, Brake	



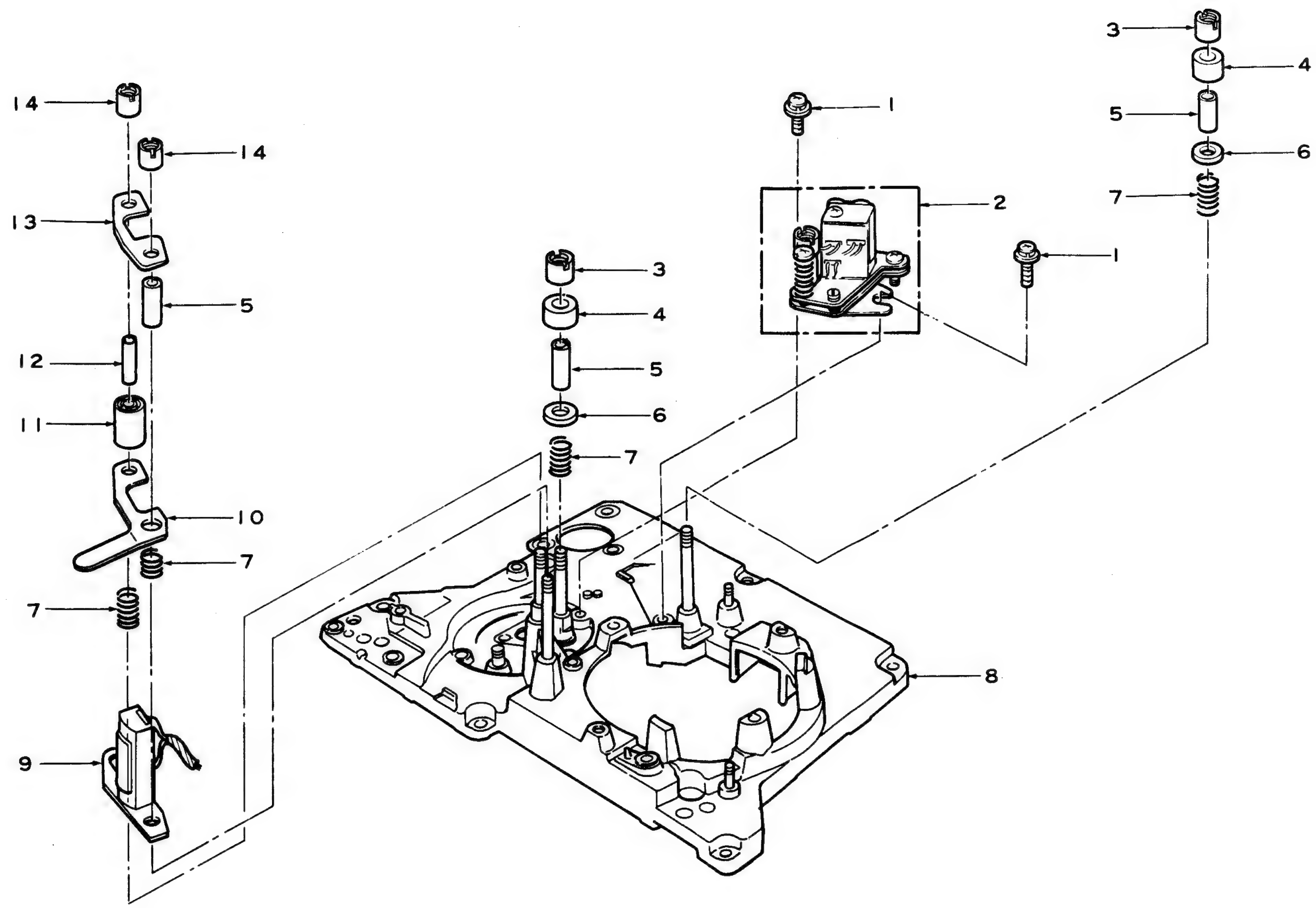
12. CYLINDER ASSEMBLY (1)

Key Number	Location Number	Part Number	Description	Remarks
1	G120A		Screw, 3 x 8 MM	
2	G120C		Washer	
3	G120B		Washer, 3 MM	
4	G132	70321232	Tape Holder Ass'y	
5	RL92E		Washer, 3 MM	
6	RL92B		Screw, 3 x 0.5 x 6 MM	
7	RL92C		Lead Holder	
8	G133B		Screw, 3 x 0.5 x 10 MM	
9	RL92		Dew Heater	
10	RL92A		Tube, Dew Heater	
11	G131	70321343	Upper Cylinder	
12	G011	70311085	Cylinder Ass'y	
13	G136		Tape Holder, A	
14	G110A		Screw, 2.6 x 5 MM	
15	G110	70193220	PC Board Ass'y, Relay	
16	G101		Cylinder, Lower	
17	G001A		Screw, 4 x 8 MM	
18	G153D		Screw, 3 x 6 MM	
19	G153		Shield, Case Ass'y	
20	G137B		Bracket, Dew Sensor	
21	W153		Lug, Dew Sensor	
22	G137		Tape Holder, B	
23	RL91		Dew Sensor	
24	G120	70321488	Video Head Ass'y	
25	G152A		Screw, 2 x 5 MM	
26	G151A		Screw, 4 x 6 MM	
27	G151	70125052	Rotor Ass'y	
28	G152	70125053	Stator	
29	G154		Shield Plate	



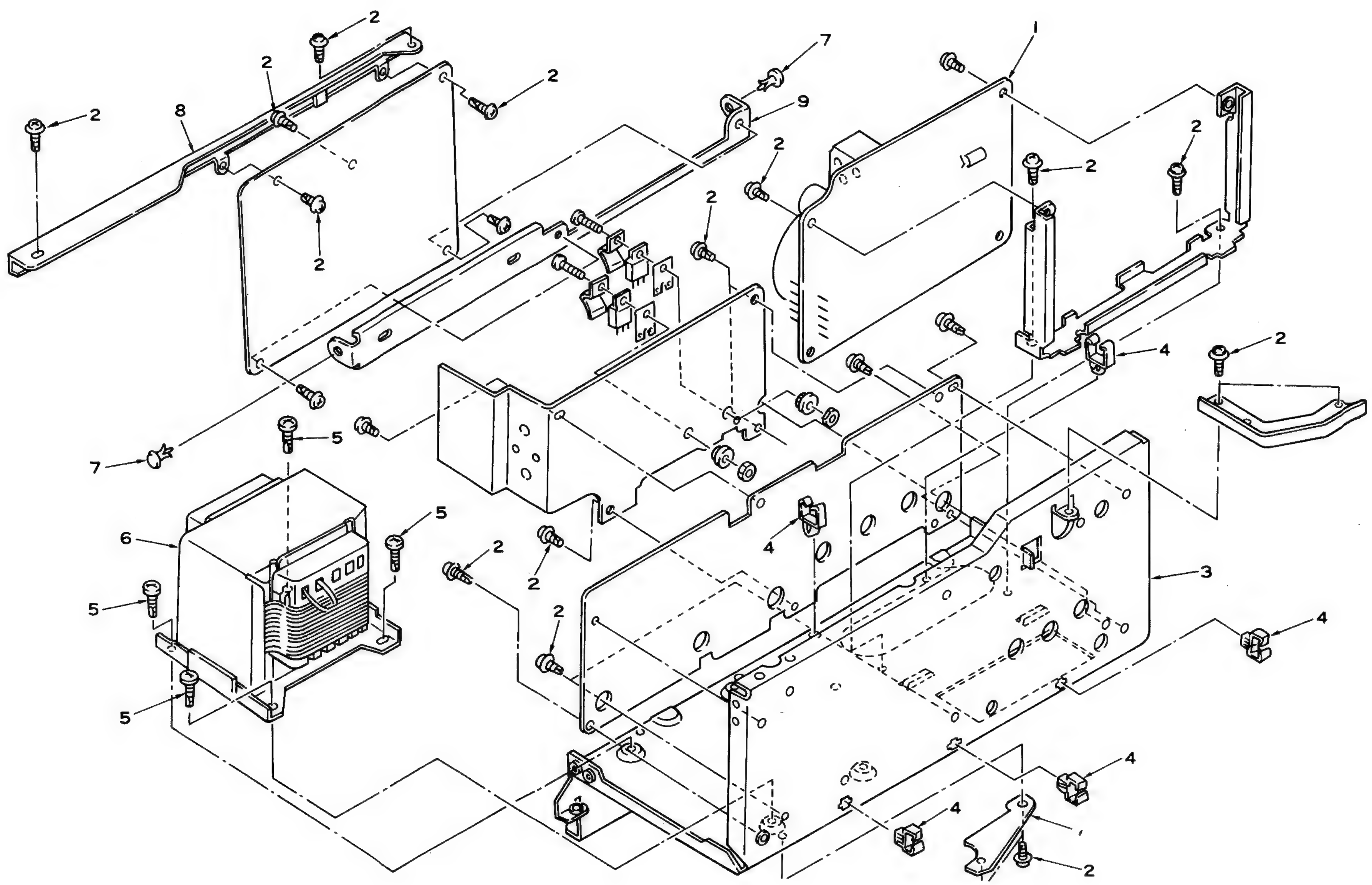
13. CYLINDER ASSEMBLY (2)

Key Number	Location Number	Part Number	Description	Remarks
1	G202A		Screw, 3 x 10 MM	
2	G202	70311082	Guide Ass'y, Exit	
3	G227		Nut, B	
4	G231		Flange, Exit Guide, Upper	
5	G221		Guide Pole, Entrance	
6	G232		Flange, Exit Guide, Lower	
7	G228		Spring, Tape Exit Guide	
8	G201		Cylinder Base Sub Ass'y	
9	H032	70183008	Head, Full Width Erase Ass'y	
10	G225		Bracket, Entrance Guide, Lower	
11	G222	70321367	Roller Ass'y, Impedance	
12	G223	70321369	Spacer, Entrance Guide	
13	G224		Bracket, Entrance Guide, Upper	
14	G226		Nut, A	



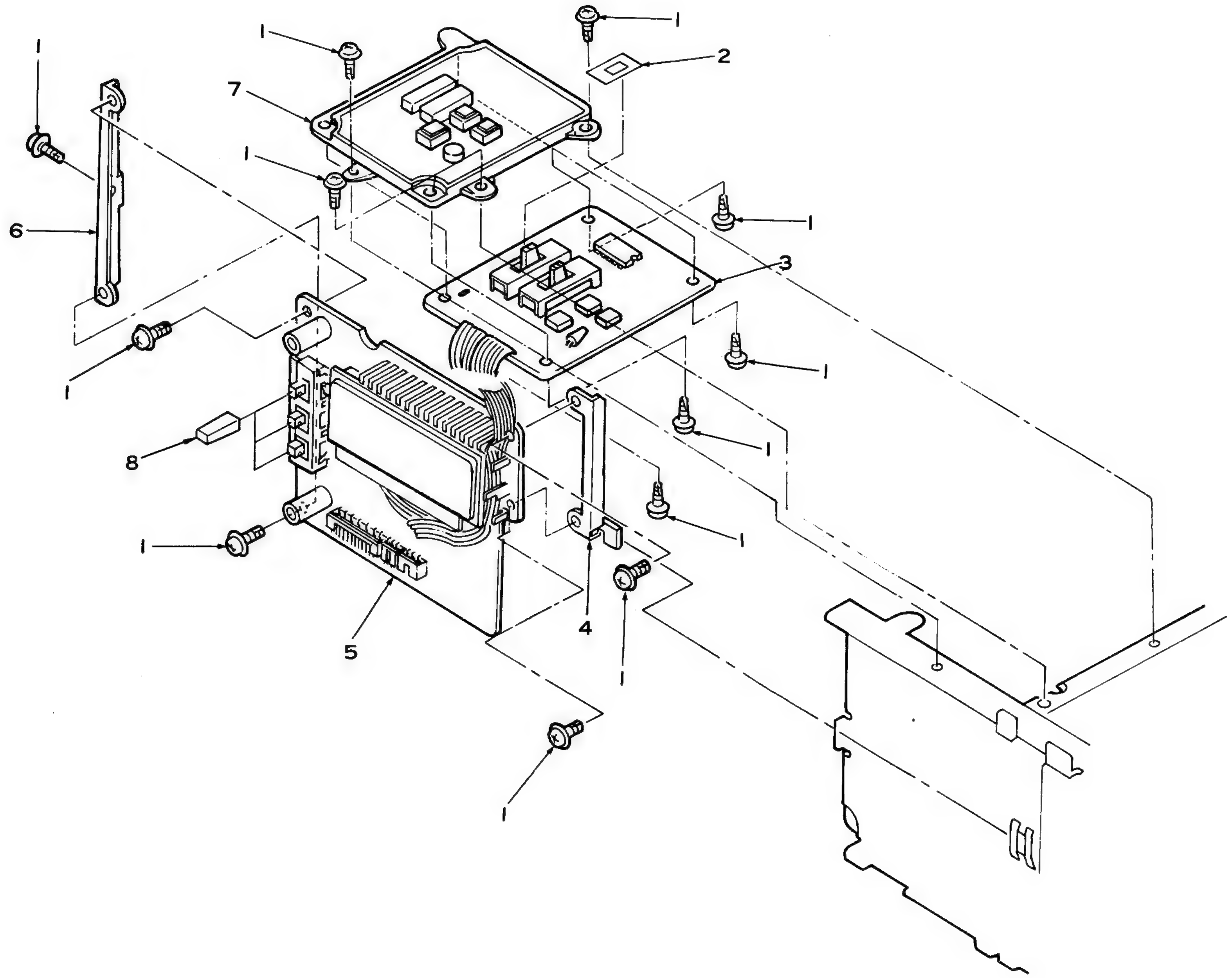
14. LEFT CHASSIS ASSEMBLY (1)

Key Number	Location Number	Part Number	Description	Remarks
1	U802		PC Board Ass'y, Power	
2	B663A		Screw, 3 x 8 MM	
3	B604		Frame Left	
4	B604B		Wire Clamper	
5	T802F		Screw, 4 x 10 MM	
6	T802		Transformer, Power	
7	U801B		Rivet, Nylon	
8	B660		Retainer	
9	B659		Retainer	



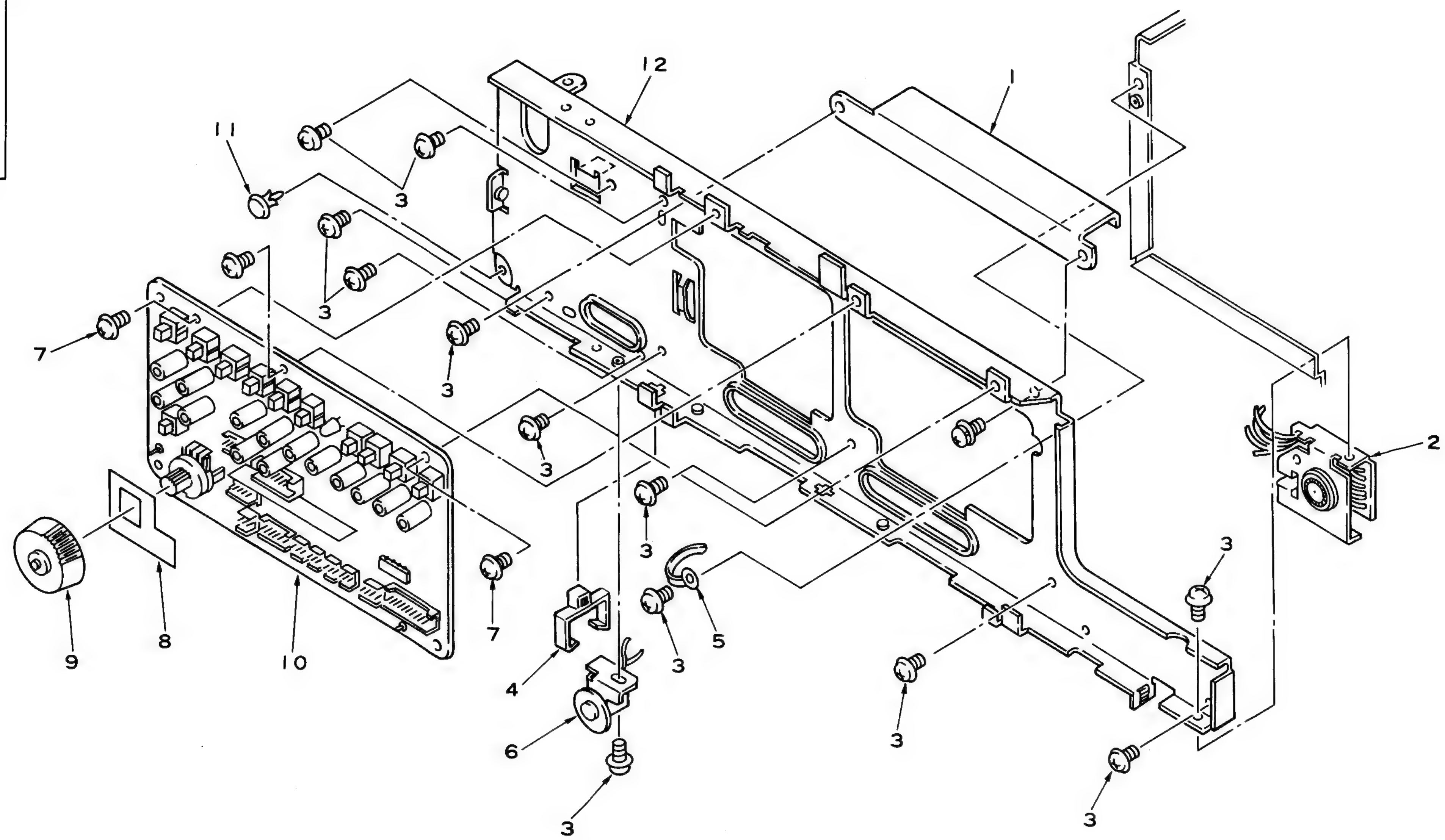
15. LEFT CHASSIS ASSEMBLY (2)

Key Number	Location Number	Part Number	Description	Remarks
1	B656D		Screw, 3 x 8 MM	
2	B656E		Cover, Time Knob	
3	UX02		PC Board Ass'y, Timer Setting	
4	VX02		Retainer	
5	UX01		PC Board Ass'y, Timer	
6	VX04		Retainer	
7	B656		Holder, Timer Setting	
8	A113	70816207	Knob	



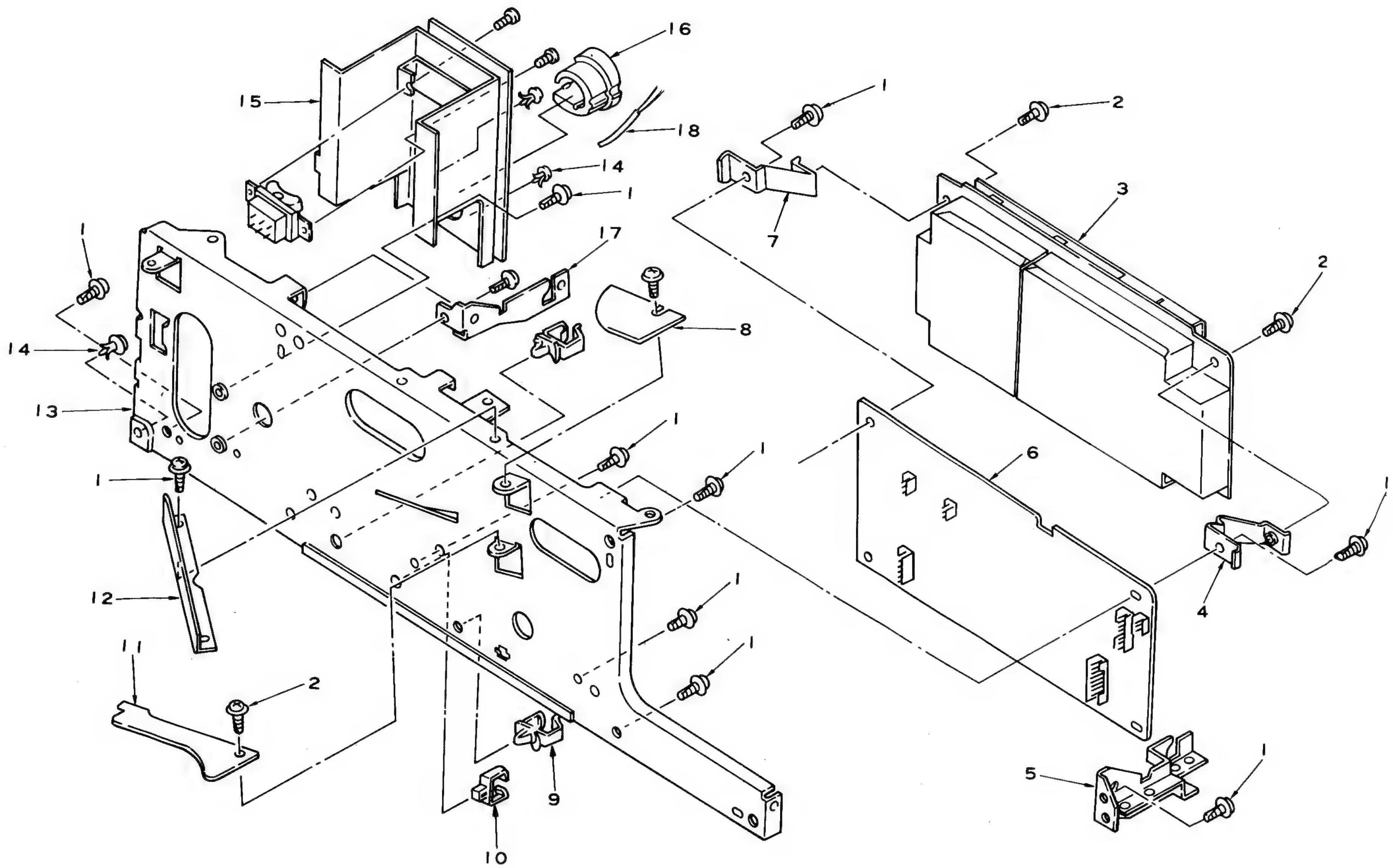
16. FRONT CHASSIS ASSEMBLY

Key Number	Location Number	Part Number	Description	Remarks
1	B605		Plate, Cassette Guide	
2	VR91		Bracket, Remote	
3	U201B		Screw, Tapping	
4	B601B		Wire Clamper	
5	B601C		Wire Clamper	
6	A108	70810055	Cover, Remote Control Jack	
7	UL01A		Screw, 3 x 6 MM	
8	A111	70810069	Cover, Tracking	
9	A105	70816178	Knob, Tracking	
10	UL01		PC Board Ass'y, LOGIC CONTROL	
11	U801B		Rivet, Nylon	
12	B601		Frame, Front	



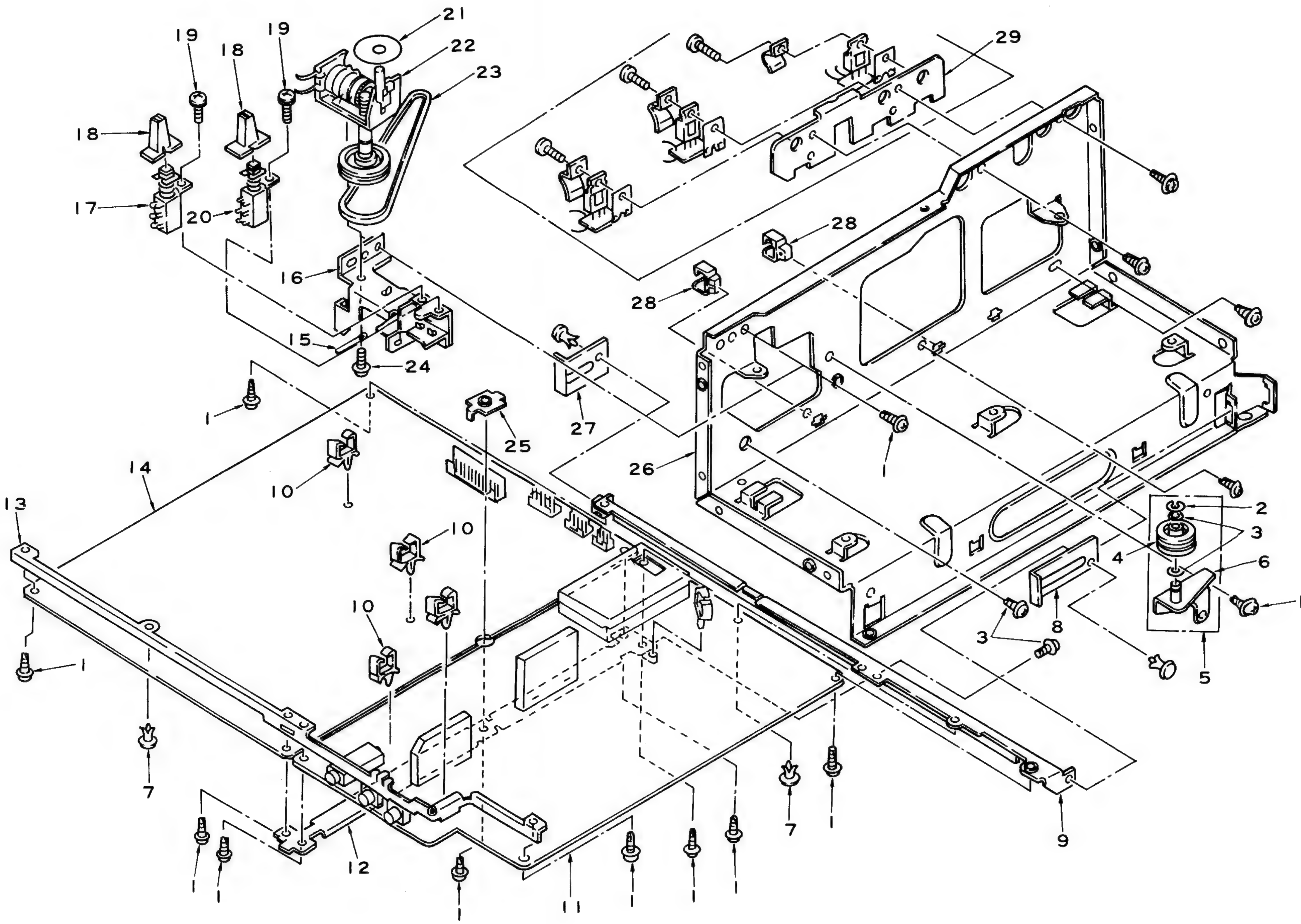
17. BACK CHASSIS ASSEMBLY

Key Number	Location Number	Part Number	Description	Remarks
1	B672A		Screw, Tapping	
2	U101A		Screw, 3 x 6	
3	U101		PC Board Ass'y, AUDIO & PRE-AMP	
4	B671		Bracket, PRE-AMP, Right	
5	B606		Bracket, AUDIO, A	
6	UY01		PC Board Ass'y, SERVO (2)	
7	B672		Bracket, PRE-AMP, Left	
8	K633		Guide Plate, Pinch Roller	
9	B602D		Wire Clamper	
10	B602E		Wire Clamper	
11			Plate, Pick Up	
12	B612		Bracket, B	
13	B602		Frame, Front	
14	U801B		Rivet, Nylon	
15	P85B		Bracket, Power Cord	
16	P811A	70841119	Holder, Cord	
17	B607		Bracket, AUDIO, B	
18	P811	23176319	Power Cord	



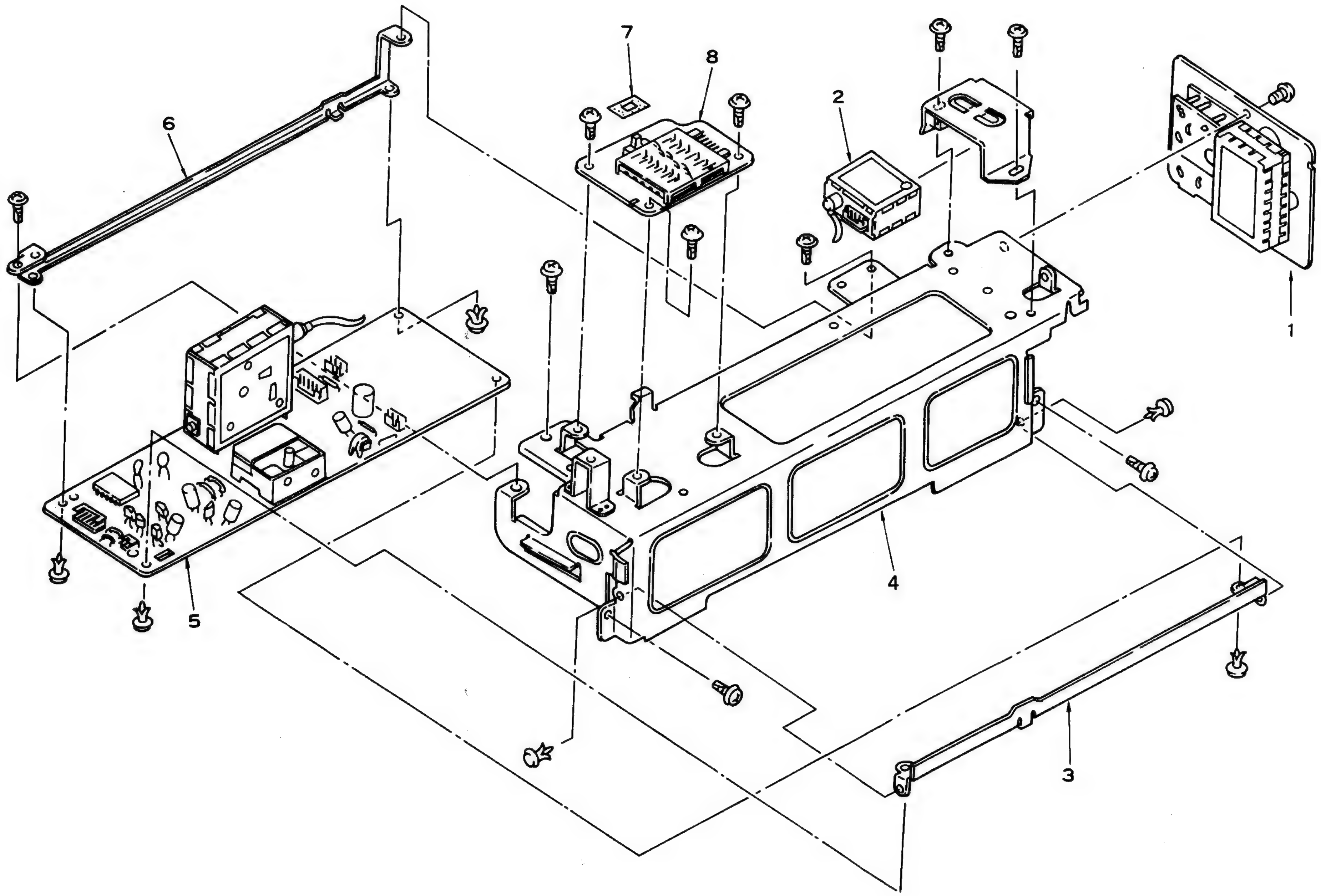
18. RIGHT CHASSIS ASSEMBLY

Key Number	Location Number	Part Number	Description	Remarks
1	B673A		Screw, Tapping	
2	K629		E Washer	
3	K630		Washer, Polyslider	
4	K628	70341262	Pulley, Relay	
5	K626	70326356	Pulley Ass'y, Relay	
6	K627		Bracket, Relay Pulley	
7	B609A		Rivet Nylon	
8	B609		Bracket, Slide, B	
9	B653		Retainer	
10	B603		Wire Clamper	
11	U201		PC Board Ass'y, VIDEO	
12	B651		Retainer	
13	B652		Retainer	
14	U501		PC Board Ass'y, SERVO & LOGIC	
15	S654G		Wire Clamper	
16	S654A		Bracket, Counter	
17	S656	70145106	Switch, Push	
18	A112	70831106	Knob, P, Q, S	
19	S656A		Screw, 2.6 x 5 MM	
20	S657	70145105	Switch, Push	
21	A110		Cover, Counter Knob	
22	S654	70104011	Counter Ass'y	
23	K625	70342078	Belt, Square, Counter	
24	S654B		Screw, 3 x 6 MM	
25	B654		Bracket	
26	B603		Frame, Right	
27	B608		Bracket, Slide, A	
28	B603B		Wire Clamper	
29	B673		Bracket	



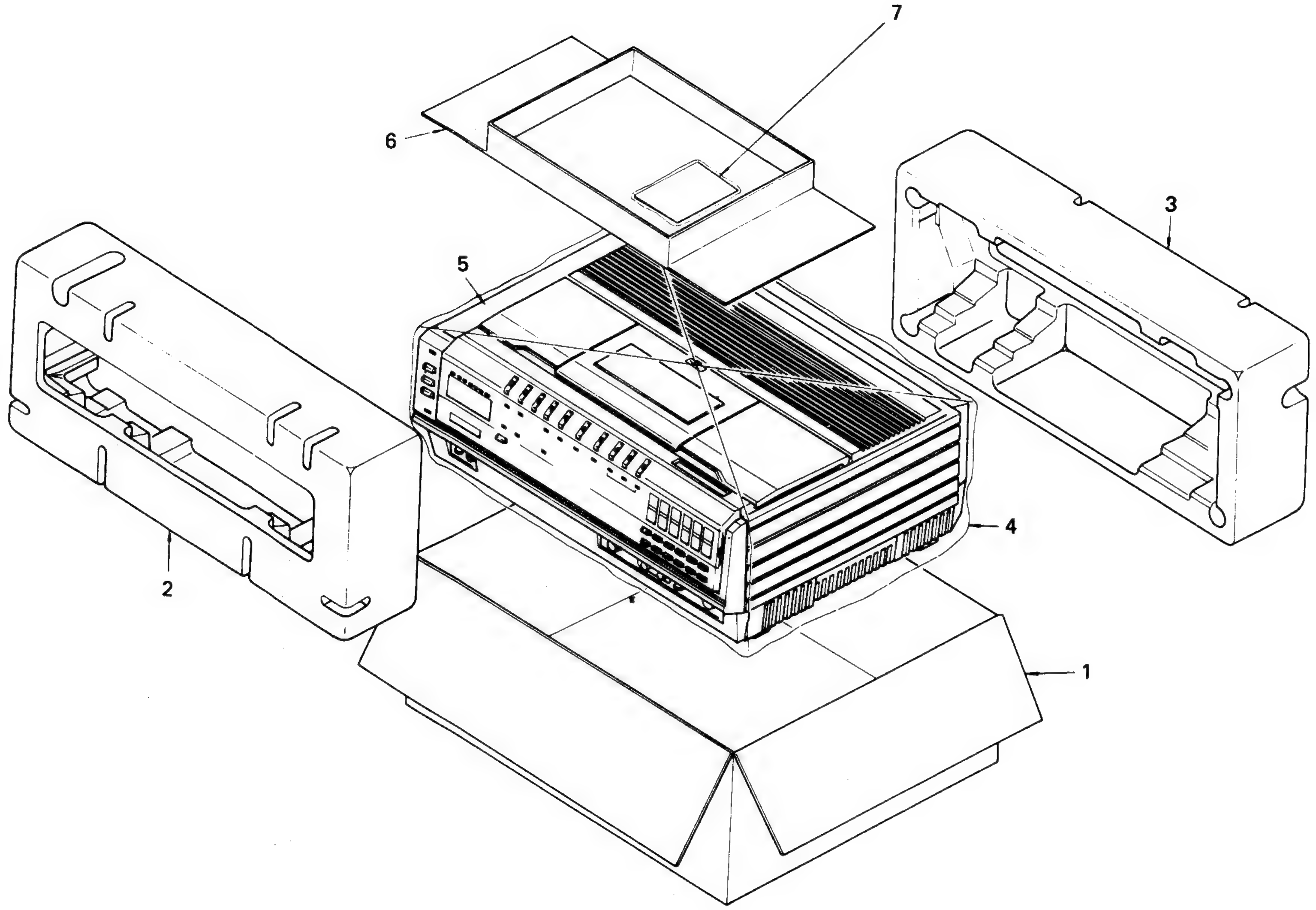
19. TUNER CHASSIS ASSEMBLY

Key Number	Location Number	Part Number	Description	Remarks
1	H003	70142025	Terminal Board, Antenna	
2	H004	70123041	RF, Unit	
3	E151		Retainer, Right	
4	E101		Tuner, Frame	
5	U001	70191601	PC Board Ass'y, Selector	
6	E152		Retainer, Left	
7	A109		Cover, Slide Switch	
8	U002		PC Board Ass'y, Channel Setting	



20. PACKING ASSEMBLY

Key Number	Location Number	Part Number	Description	Remarks
1	A701	70913097	Carton Box (V8600)	
		70913096	Carton Box (V8700)	
2	A702	70921053	Packing, Front	
3	A703	70941054	Packing, Back	
4	A704	70922018	Polyethylene Bag	
5	A706	70922017	Sheet	
6	A707	70914003	Tray	
7	Y001		Accessary	
	Y101	70941180	Owner's Manual (E/F/G)	
	Y101A	70941181	Owner's Manual (D/I/S)	
	Y102	70942020	Caution Sheet	
	Y103	70942094	Quick Reference card, English	
	Y103A	70942095	Quick Reference card, German	
	Y103B	70942096	Quick Reference card, French	
	Y103C	70942097	Quick Reference card, Dutch	
	Y103D	70942098	Quick Reference card, Italy	
	Y103E	70942099	Quick Reference card, Spanish	
	Y104	70168035	Cable	
	Y106	70148018	Remote Control Hand Set (V8600)	
	Y106	70148023	Transmitter (V8700)	
	Y106A	70148025	Receiver (V8700)	
	Y109	70933020	Cover	



SECTION 7 ELECTRICAL PARTS

ABBREVIATIONS:
Capacitors . . . CD: Ceramic Disk, PF: Plastic Film, EL: Electrolytic
Resistors . . . . CF: Carbon Film, CC: Carbon Composition, OMF: Oxide Metal Film, VR: Variable Resistor

(All CD and PF capacitors are ±5%, 50V and all resistors, ±5%, 1/8W unless otherwise noted.)
NOTE: The parts identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

SELECTOR UNIT 70191601

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CAPACITORS		
C001, C002, C003, C004, C009, C010, C013, C022, C026, C028, CA01, CA03, CA04, CA08	24232103	CD, 0.01μF, +80%, −20%, 50V
C005	24232102	CD, 0.001μF, +80%, −20%, 50V
C006, C024, CA05, CA07	24636478	EL, 0.47μF, 50V
C007	24636229	EL, 2.2μF, 50V
C008	24636479	EL, 4.7μF, 50V
C011, C012	24636339	EL, 3.3μF, 50V
C014, C025	24633101	EL, 100μF, 16V
C015, C016	24436020	CD, 2pF, ±0.25PF, 50V
C017	24436110	CD, 11pF, ±5%, 50V
C018	24436680	CD, 68pF, ±5%, 50V
C019	24633471	EL, 470μF, 16V
C020, C021	24436470	CD, 47pF, ±5%, 50V
C023	24692752	PF, 0.0075μF, ±5%, 50V
C027	24633100	EL, 10μF, 16V
CA02	24692223	PF, 0.022μF, ±5%, 50V
CA06	24636010	EL, 1μF, 50V
RESISTORS		
R001	24360101	CF, 100 ohm
R002	24360221	CF, 220 ohm
R003, R031 R032, R033	24360562	CF, 5.6K ohm
R004	24360471	CF, 470 ohm
R005, R018, R020, R024, R026, RA12	24360102	CF, 1K ohm
R006	24360270	CF, 27 ohm
R007	24360821	CF, 820 ohm
R008	24360392	CF, 3.9K ohm
R009	24360913	CF, 91K ohm
R010	24360164	CF, 160K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R011	24360271	CF, 270 ohm
R012	24360624	CF, 620K ohm
R013, R014, RA06, RA11, RA13, RA26	24360563	CF, 56K ohm
R015	24360824	CF, 820K ohm
R016	24360152	CF, 1.5K ohm
R017	24360431	CF, 430 ohm
R019	24360681	CF, 680 ohm
R021, RA05, RA07	24360752	CF, 7.5K ohm
R022	24360202	CF, 2K ohm
R023	24941821	CC, 820 ohm
R025	24360682	CF, 6.8K ohm
R027	24360473	CF, 47K ohm
R029	24360224	CF, 220K ohm
R030	24360564	CF, 560K ohm
R051	24061957	VR, 500K ohm, 1/2W
R052	24061526	VR, 10K ohm, 1/2W
R091	24381680	OMF, 68 ohm, 1/2W
R092	24381222	OMF, 2.2K ohm, 1/2W
RA01	24360103	CF, 10K ohm
RA02	24360273	CF, 27K ohm
RA03	24360683	CF, 68K ohm
RA04	24360153	CF, 15K ohm
RA08, RA14, RA24	24360332	CF, 3.3K ohm
RA09	24360104	CF, 100K ohm
RA10, RA15, RA20, RA23, RA25	24360243	CF, 24K ohm
RA16	24941561	CC, 560 ohm, 1/4W
RA17	24360124	CF, 120K ohm
RA18	24360154	CF, 150K ohm
RA19	24360123	CF, 12K ohm
RA21	24360105	CF, 1M ohm
RA22	24360364	CF, 360K ohm
SEMICONDUCTORS		
IC002	B0354710	IC, TA7607AP, PIF, AFT
IC006	B0316451	IC, TA7176AP, FA-1, SIF

LOCATION NUMBER	PART NUMBER	DESCRIPTION
ICA01	70119177	IC, UPC-1363C
Q001	A6708871	NPN, Transistor, 2SC388ATM, FA
Q003	A6048371	FET, 2SK30ATM-GR, FA
Q004, Q007, QA03, QA04, QA05, QA06, QA08, QA09	A6317547	PNP, Transistor, 2SC1815NEW, Y, FA
Q005, Q008 Q009, Q010 QA02, QA07	A6534045	PNP, Transistor, 2SA1015Y, FA
D001, D002, D003, DA01, DA02, DA03, DA04	A7246711	Diode, 1S1555 (TV)
D004	23115878	Zener Diode, μPC574JC
COILS		
L001	23262951	Coil, TRF1019, Choke
L002	23261985	Coil, TRF9221, Choke
L003	23262863	Coil, TRF1448, PIF
L004, L005	23262881	Coil, TRF1445, AFT
L006	23283150	Coil, TRF4150JG, Peaking
L007	23283180	Coil, TRF4180JG, Peaking
L008	23283120	Coil, TRF4120JG, Peaking
L009	23252954	Coil, TRF6410, SIF
MISCELLANEOUS		
Z001	A5611110	PSF, F1034, PIF, Filter
Z002	23107972	Ceramic Filter, 5.5 MHz
Z003	23107008	Ceramic Filter, 5.5 MHz 150 kHz
P001	70165094	Plug, 14P, BRN
P002	70165083	Plug, 3P, BRN
P003	23164660	Plug, 7P, BRN
P004	23164671	Plug, 3P, BRN
P005	23164672	Plug, 3P, BLK
P007	23162043	Terminal
H001	23121846	Tuner, EG411, UHF/VHF

SETTING UNIT 70191604

RESISTORS		
R055	70421137	VR, Potentiometer
R056	70421132	VR, Potentiometer

LOCATION NUMBER	PART NUMBER	DESCRIPTION
SEMICONDUCTORS		
DA75, DA76 DA77, DA78 DA79, DA80 DA81, DA82 DA83, DA84 DA85, DA86 DA87, DA88 DA89, DA90 DA91, DA92 DA93, DA94 DA95, DA96 DA97, DA98	A7246711	Diode, 1S1555
MISCELLANEOUS		
SA51	23145747	Switch Slide, 2C2P

KEYBOARD UNIT 70191546

SEMICONDUCTORS		
DA51, DA52, DA53, DA54, DA55, DA56, DA57, DA58, DA59, DA60, DA61, DA62	A7246711	Diode, 1S1555
DA63, DA64, DA65, DA66, DA67, DA68, DA69, DA70, DA71, DA72 DA73, DA74	A8605666	LED, TLG113A
MISCELLANEOUS		
SA01, SA02, SA03, SA04, SA05, SA06, SA07, SA08, SA09, SA10, SA11, SA12	70145119	Switch Tact

PRE AMP UNIT 70191547

CAPACITORS		
C101, C102, C103, C106, C108, C116, C117, C118, C120, C128	24232223	CD, 0.022μF, +80%, -20% 50V

LOCATION NUMBER	PART NUMBER	DESCRIPTION
C130, C142, C147	24232223	CD, 0.022μF, +80%, −20%, 50V
C104, C107, C109, C119, C121, C131, C133	24633100	EL, 10μF, 16V
C105, C110, C111, C112, C113, C114, C115, C126, C136, C137, C143, C146, C162	24232103	CD, 0.01μF, +80%, −20%, 50V
C122, C123	24436680	CD, 68pF
C124, C135	24436101	CD, 100pF
C125	24436471	CD, 470pF
C127	24867562	PF, 0.0056μF
C129	24436331	CD, 330pF
C134	24436131	CD, 130pF
C138, C139	24633220	EL, 22μF, 16V
C140	24436431	CD, 430pF
C141	24436271	CD, 270pF
C144, C163, C164, C165	24633470	EL, 47μF, 16V
C145	24353111	CD, 110μF
C151, C152, C153, C154	70417013	Trimmer, 121A
CX81	24632471	EL, 470μF, 10V
CX82	24633471	EL, 470μF, 16V
CX83	24636010	EL, 1μF, 50V

RESISTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R101	24360103	CF, 10K ohm
R102, R130, R131	24380222	CF, 2.2K ohm
R103	24360473	CF, 47K ohm
R104	24380750	CF, 75 ohm
R105	24380182	CF, 1.8K ohm
R106, RX81, RX84, RX90	24380103	CF, 10K ohm
R107, R143, RX86, RX87	24360472	CF, 4.7K ohm
R110, R112, R128, R129, R138, RX89	24360222	CF, 2.2K ohm
R113	24380102	CF, 1K ohm
R114, R116, R136	24360562	CF, 5.6K ohm
R115, R123, R124, R126, R127, R135, R146, R182	24360102	CF, 1K ohm
R120	24360221	CF, 220 ohm
R121	24380471	CF, 470 ohm
R122	24360689	CF, 6.8 ohm
R125, R134, R175, R176	24360681	CF, 680 ohm
R132	24360822	CF, 8.2K ohm
R133	24360273	CF, 27K ohm
R137	24360682	CF, 6.8K ohm
R139	24360271	CF, 270 ohm
R140	24380333	CF, 33K ohm
R141	24360910	CF, 91 ohm
R142	24360622	CF, 6.2K ohm
R144, R163, R165	24380202	CF, 2K ohm
⚠R145	24531330	Fusible, 33 ohm, 1/2W
R147	24360163	CF, 16K ohm
R148, R172	24360911	CF, 910 ohm
R149	24360133	CF, 13K ohm
R151, R152, R153, R154	24061144	VR, 47K ohm, 0.15W
R155, R156	24061320	VR, 2.2K ohm, 0.15W
R157	24061138	VR, 4.7K ohm, 0.15W
R158	24061137	VR, 3.3K ohm, 0.15W
R161	24360912	CF, 9.1k ohm
R162, R174	24360101	CF, 100 ohm
R164	24380332	CF, 3.3K ohm
R166	24360302	CF, 3K ohm
R167	24380562	CF, 5.6K ohm
R168	24380302	CF, 3K ohm
R169, RX93	24380432	CF, 4.3K ohm
R170	24380301	CF, 300 ohm
R171	24380162	CF, 1.6K ohm
R173	24380392	CF, 3.9K ohm
R177	24360223	CF, 22K ohm
R178, R183	24380101	CF, 100 ohm
R179	24380472	CF, 4.7K ohm
R180	24380152	CF, 1.5K ohm
R181	24360181	CF, 180 ohm
RX82	24380621	CF, 620 ohm
RX83	24380121	CF, 120 ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
RX85	24380362	CF, 3.6K ohm
RX88	24360333	CF, 33K ohm
RX91	24380122	CF, 1.2K ohm
RX92	24380822	CF, 8.2K ohm
SEMICONDUCTORS		
IC101	70119048	IC, CX-134A, H-AMP
IC102	B0356302	IC, TA7636P, FA-2
ICX81	70119173	IC, TL496
Q105, Q106, Q107, Q108	70114087	FET, 2SK43-3
QX82	A6534045	PNP, Transistor, 2SA1015Y
Q103, Q104, Q109, Q110, Q111, Q112, Q113, Q114, Q115	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
Q103, Q104, Q109, Q110, Q112, Q113, Q114, Q115	A6317526	NPN, Transistor, 2SC1815NEW, O, FA
QX85	A6509141	PNP, Transistor, 2SA562TM, Y, FA
D101, D102, D103, D104, D105	A7249501	Diode, 1S1587, V
D106, D107, DX83	A7246711	Diode, 1S1555V
DX82	A7109432	Zener Diode, 05Z4.3-X
DX81, DX84	A7110016	Zener Diode, 05Z5.6-X
DX84	A7110002	Zener Diode, 05Z5.6-L
DX81	A7110017	Zener Diode, 05Z5.6-Y
COILS		
L101	23283221	Coil, TRF4221JG, Peaking
L102	23283470	Coil, TRF4470JG, Peaking
L105, L108	23283682	Coil, TRF4682JG, Peaking
L106, L114	23283100	Coil, TRF4100JG, Peaking
L107	23283120	Coil, TRF4120JG, Peaking
L109	23283152	Coil, TRF4152JG, Peaking
L110	23283121	Coil, TRF4121JG, Peaking
L111, L113	23283180	Coil, TRF4180JG, Peaking
L112	23283102	Coil, TRF4102JG, Peaking
LX81	70211039	Coil, 50MICRO, Choke

LOCATION NUMBER	PART NUMBER	DESCRIPTION
T101, T102, T103, T104	23254983	TRS, TRF7006
MISCELLANEOUS		
Z101	70132023	Filter, LC-660A
P101	23164663	Plug, 6P, BLK
P102	23164662	Plug, 6P, BRN
P103	23164659	Plug, 8P, BRN
P104	23164660	Plug, 7P, BRN
P105	23162043	Terminal
PX81	23164672	Plug, 3P, BLK
X101	70138004	1H Delay Line, ADL-CL042T

VIDEO UNIT 70191548

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CAPACITORS		
C201	24436241	CD, 240pF
C202, C217, C468	24436560	CD, 56pF
C203, C230, C236, C315, C467	24436101	CD, 100pF
C204, C220, C221, C224, C225, C227, C228, C231, C232, C242, C245, C249, C261, C262, C264	24232103	CD, 0.01μF, +80%, —20%, 50V
C265, C266, C267, C269, C270, C277, C297, C304, C311, C317, C403, C419, C435, C438, C476	24232103	CD, 0.01μF, +80%, —20%, 50V
C205, C214, C263, C431	24633100	EL, 10μF, 16V
C206, C207, C213, C222	24232223	CD, 0.022μF, +80%, —20%, 50V

LOCATION NUMBER	PART NUMBER	DESCRIPTION
C226, C234, C238, C240, C248, C292, C301, C303, C412, C414, C432, C442	24232223	CD, 0.022μF, +80%, –20%, 50V
C210, C211, C216	24635479	EL, 4.7μF, 35V
C212, C215, C229	24867473	PF, 0.047μF
C218, C407, C430	24436471	CD, 470pF
C219, C268	24436151	CD, 150pF
C223	24636229	EL, 2.2μF, 50V
C233, C239, C275, C288, C294, C305, C307, C421	24636010	EL, 1μF, 50V
C235, C246, C247, C281, C302, C318, C415, C434, C436, C443, C448, C474, C475, C479	24633470	EL, 47μF, 16V
C237, C314	24436331	CD, 330pF
C241, C299, C433	24436330	CD, 33pF
C243, C244, C441	24436271	CD, 270pF
C260	24636478	EL, 0.47μF, 50V
C271, C289	24436221	CD, 220pF
C272, C273	24867152	PF, 0.0015μF
C282	24212821	CD, 820pF, ±10%, 50V
C290	24867472	PF, 0.0047μF
C293	24212472	CD, 0.0047μF, ±10%, 50V
C295, C312, C427	24212102	CD, 0.001μF, ±10%, 50V
C296	24353270	CD, 27μF
C298	24436121	CD, 120pF
C300	24436270	CD, 27pF
C306, C308	24867123	PF, 0.012μF
C309	24353160	CD, 16μF
C310	24353470	CD, 47μF
C313	24436150	CD, 15pF
C319	24436200	CD, 20pF
C320	24436300	CD, 30pF

LOCATION NUMBER	PART NUMBER	DESCRIPTION
C401, C428, C437, C440, C460, C461	24632101	EL, 100μF, 10V
C402	24633330	EL, 33μF, 16V
C404	70412005	Tantal, 0.22μF, 35V
C405, C426	24867223	PF, 0.022μF
C406	24632220	EL, 22μF, 10V
C410	24867104	PF, 0.1μF
C411, C445	24436821	CD, 820pF
C413, C446	24436181	CD, 180pF
C416	24359181	CD, 180μF
C418	24436681	CD, 680pF
C420, C422, C423, C429, C466, C477	24633220	EL, 22μF, 16V
C424	24632102	EL, 0.001μF, 10V
C425	24867183	PF, 0.018μF
C439	24436201	CD, 200pF
C444	24436390	CD, 39pF
C447	24212222	CD, 0.0022μF, ±10%, 50V
C449	24436820	CD, 82pF
C462	24353111	CD, 110μF
C463	24867562	PF, 0.0056μF
C464, C465	24436511	CD, 510pF
C478	24436510	CD, 51pF

RESISTORS

R201, R364, R402	24360112	CF, 1.1K ohm
R202, R206, R225, R228, R279, R296, R321, R325, R338, R376, R377, R401, R403, R406, R416, R417, R424, R439, R446, R460	24360102	CF, 1K ohm
R203, R269, R324	24360471	CF, 470 ohm
R204, R205, R207, R208, R223, R224, R226, R227	24360473	CF, 47K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R266, R344, R390, R474, R490	24360473	CF, 47K ohm
R209, R211, R212, R213, R214, R283, R323, R395, R428, R431, R482, R486	24360223	CF, 22K ohm
R210, R273, R277, R282, R302, R314, R320, R335, R375, R412	24360103	CF, 10K ohm
R215, R317	24360224	CF, 220K ohm
R216	24360273	CF, 27K ohm
R217, R305, R340, R369, R478	24360562	CF, 5.6K ohm
R218, R301, R399	24360333	CF, 33K ohm
R219, R268, R341, R405, R423	24360221	CF, 220 ohm
R220, R233, R313, R318, R397, R495	24360472	CF, 4.7K ohm
R221, R496	24360104	CF, 100K ohm
R222	24360563	CF, 56K ohm
R229	24380303	CF, 30K ohm
R230	24380183	CF, 18K ohm
R231, R265, R274, R330, R414, R445	24380102	CF, 1K ohm
R232, R441, R487	24380223	CF, 22K ohm
R234, R236, R237, R238, R239, R241, R433, R488	24360391	CF, 390 ohm
R235, R247, R327, R409, R421, R432, R443, R489, R497	24360222	CF, 2.2K ohm
R240	24380182	CF, 1.8K ohm
R242, R389	24360681	CF, 680 ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R396	24360681	CF, 680 ohm
R243, R287	24360511	CF, 510 ohm
R244	24380562	CF, 5.6K ohm
R245, R385	24360432	CF, 4.3K ohm
R246, R286, R307, R465	24360332	CF, 3.3K ohm
R248	24380511	CF, 510 ohm
R249	24360820	CF, 82 ohm
R251	24061247	VR, 22K ohm, 0.15W
R252, R351	24061245	VR, 10K ohm, 0.15W
R253	24061237	VR, 470 ohm, 0.15W
R254, R255, R353, R451	24061241	VR, 2.2K ohm, 0.15W
R256	71061240	VR, 1.5K ohm, 0.15W
R257, R350, R354	24061239	VR, 1K ohm, 0.15W
R258	24061255	VR, 470K ohm, 0.15W
R260, R329, R372, R430	24360821	CF, 820 ohm
R261, R270	24380391	CF, 390 ohm
R262, R334, R382, R491	24380332	CF, 3.3K ohm
R263, R425	24360272	CF, 2.7K ohm
R264, R278, R410, R411, R426, R485	24360331	CF, 330 ohm
R267, R436	24380152	CF, 1.5K ohm
R271	24360560	CF, 56 ohm
R272, R309, R322	24360153	CF, 15K ohm
R275, R449, R481	24380222	CF, 2.2K ohm
R276, R331, R336	24380563	CF, 56K ohm
R280	24380122	CF, 1.2K ohm
R281, R295, R365, R464, R494	24360152	CF, 1.5K ohm
R284, R349	24360751	CF, 750 ohm
R285, R289, R381, R438, R463, R479	24360202	CF, 2K ohm
R288	24360242	CF, 2.4K ohm
R290	24380203	CF, 20K ohm
R291, R304, R332	24380103	CF, 10K ohm
R292, R383	24360622	CF, 6.2K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R404, R480	24360622	CF, 6.2K ohm
R293, R315, R374	24360512	CF, 5.1K ohm
R294	24360105	CF, 1M ohm
R297, R384, R386, R392	24360302	CF, 3K ohm
R300	24360243	CF, 24K ohm
R303	24380682	CF, 6.8K ohm
R306, R345	24380101	CF, 100 ohm
R310, R373, R472, R473	24360752	CF, 7.5K ohm
R311, R339, R380	24360682	CF, 6.8K ohm
R312, R360, R400, R444	24360101	CF, 100 ohm
R316, R370, R371, R407, R420, R437	24360182	CF, 1.8K ohm
R319	24380333	CF, 33K ohm
⚠R326	24531330	Fusible, 33 ohm, 1/2W
R328, R348	24360393	CF, 39K ohm
R333, R462	24360822	CF, 8.2K ohm
R337, R342	24380681	CF, 680 ohm
R343, R419	24360912	CF, 9.1K ohm
R346, R391, R476	24380473	CF, 47K ohm
R347, R447	24380561	CF, 560 ohm
R352	24061137	VR, 3.3K ohm, 0.15W
R356, R359	71061134	VR, 1K ohm, 0.15W
R357	71061136	VR, 2.2K ohm, 0.15W
R358	24061242	VR, 3.3K ohm, 0.15W
R361	24380112	CF, 1.1K ohm
R362	24380162	CF, 1.6K ohm
R363	24360162	CF, 1.6K ohm
R366	24360113	CF, 11K ohm
R367, R435	24360271	CF, 270 ohm
R368, R387, R434	24360151	CF, 150 ohm
R378	24360133	CF, 13K ohm
R379	24360163	CF, 16K ohm
R388, R471	24360183	CF, 18K ohm
R393, R394, R448	24360561	CF, 560 ohm
R398	24360513	CF, 51K ohm
R408	24360621	CF, 620 ohm
R413	24360362	CF, 3.6K ohm
R415	24360750	CF, 75 ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R418	24380821	CF, 820 ohm
R422	24360132	CF, 1.3K ohm
R427, R484	24360161	CF, 160 ohm
R429	24380331	CF, 330 ohm
R440, R483	24360100	CF, 10 ohm
R442	24380271	CF, 270 ohm
R461	24380243	CF, 24K ohm
R466, R469	24360392	CF, 3.9K ohm
R467	24360122	CF, 1.2K ohm
R468	24380623	CF, 62K ohm
R470	24380822	CF, 8.2K ohm
R475	24360623	CF, 62K ohm
R477	24380104	CF, 100K ohm
⚠R492	24000952	Thermistor, 3K ohm, ±10%, B-3900
R481	24380222	CF, 2.2K ohm
R493	24380911	CF, 910 ohm
R496	24360433	CF, 43K ohm

SEMICONDUCTORS

IC402	B0356301	IC, TA7363P, FA-1
IC402	B0356302	IC, TA7363P, FA-2
IC201	70119037	IC, CX-136A, Color Process
IC202, IC203	70119066	IC, CX-130, Switching
IC204, IC205	70119167	IC, CX-150B
IC207	70119168	IC, CX-832
IC208	70119176	IC, MB-14300
IC209	70135016	IC, TVH-105
IC401	B0356320	IC, TA7637P
IC404	70135005	IC, TVH102
IC403	B0470693	C-MOS, IC, TC4069UBP
IC403	70119151	C-MOS IC, CD4069UBE
Q431	A6325540	NPN, 2SC2236-Y
Q213, Q214, Q215, Q216, Q217, Q218, Q219, Q220, Q221, Q222, Q223, Q224, Q225, Q226, Q228, Q229, Q230, Q235, Q238, Q239, Q407, Q408, Q409, Q410	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA

LOCATION NUMBER	PART NUMBER	DESCRIPTION
Q411, Q412, Q413, Q414, Q416, Q424, Q425, Q427, Q430	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
Q232, Q233, Q234, Q236, Q240, Q406, Q415, Q426, Q428	A6534045	PNP, Transistor, 2SA1015-Y, FA
Q237	A6319302	NPN, Transistor, 2SC1959NEW, Y, FA
Q213, Q214, Q215, Q216, Q217, Q218, Q219, Q220, Q221, Q222, Q223, Q224, Q225, Q226, Q228, Q229, Q230, Q235, Q238, Q239, Q407, Q408, Q409, Q410, Q411, Q412, Q413, Q414, Q416, Q424, Q425, Q427, Q430	A6317526	NPN, Transistor, 2SC1815NEW, O, FA
Q232, Q233, Q234, Q236, Q240, Q406, Q415, Q426, Q428	A6534021	PNP, Transistor, 2SA1015-O, FA
Q237	A6319283	NPN, Transistor, 2SC1959NEW-O, FA
D202, D203, D204, D205, D206, D208, D209, D401, D402, D403, D404, D405, D406, D407, D408, D409, D410, D413, D414, D415, D416, D417	A7246711	Diode, 1S1555V

LOCATION NUMBER	PART NUMBER	DESCRIPTION
D420, D421	A7246711	Diode, 1S1555V
D207, D430, D431	A7110017	Zener Diode, 05Z5.6-Y
D207, D430, D431	A7110018	Zener Diode, 05Z5.6-Z

COIL & TRANSFORMER

LOCATION NUMBER	PART NUMBER	DESCRIPTION
L201, L217	23283121	Coil, TRF4121JG, Peaking
L202	23283689	Coil, TRF4689JG, Peaking
L203, L207, L310	23283829	Coil, TRF4829JG, Peaking
L204, L218	23283680	Coil, TRF4680JG, Peaking
L205, L206, L208, L210, L211	23283471	Coil, TRF4471JG, Peaking
L209, L304	23283560	Coil, TRF4560JG, Peaking
L212	23283472	Coil, TRF4472JG, Peaking
L213	23283270	Coil, TRF4270JG, Peaking
L214	23283102	Coil, TRF4102JG, Peaking
L215	23283101	Coil, TRF4101JG, Peaking
L251, L252	70212012	Coil, TRF7041, Variable
L301, L308	23283180	Coil, TRF4180JG, Peaking
L302, L306	23283151	Coil, TRF4151JG, Peaking
L303, L309	23283820	Coil, TRF4820JG, Peaking
L307	23283330	Coil, TRF4330JG, Peaking
L312	23283221	Coil, TRF4221JG, Peaking
T201	23254988	Transformer, TRF7031, PST, 4.27 MHz
T251	23254987	Transformer, TRF7033, BAT, 3.58 MHz
T252	23252966	Coil, TRF7038, OSC, 4.43 MHz
T253	23252967	Coil, TRF7037, OSC, 4.43 MHz
T351	23252988	(TRF7023) E0T, 3.5 MHz

MISCELLANEOUS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
S201	23145719	Switch, Slide, 2C2P
Z201	70132030	LC730D, Filter
Z202	70132031	LC854, Filter
Z203	70153022	Ceramic Filter, SFE5. 12MB
Z301	70132032	LC802A, Filter
Z302, Z303	70132037	Coil, Delay line
Z304	70132023	LC-660A, Filter

LOCATION NUMBER	PART NUMBER	DESCRIPTION
P201, P219	23164665	Plug, 5P, BRN
P202, P207, P210	23164668	Plug, 4P, BRN
P203, P208	23164666	Plug, 5P, BLK
P204, P205, P206, P221	23164671	Plug, 3P, BRN
P209	23164672	Plug, 3P, BLK
P211	23164669	Plug, 4P, BLK
P212, P214	23163467	Jack, Phono, Y
P213, P215	23163469	Jack, Phono, Print
P216	23163470	Jack, 6.4M
P220	23162043	Terminal
X201	23153979	Crystal, 4.43, 25PPM
X202	23153980	Crystal, 4.43, 25PPM
X203	70153021	ADL-CF544T, 2H Delay Line
X204	23250966	PDL643K SWCC, 1H Delay Line, PAL SECAM

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CAPACITORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
C501, C505, C636	24636478	EL, 0.47μF, 50V
C502	24212471	CD, 470pF, ±10%, 50V
C503, C504, C513, C535, C624, C627, C632	24232103	CD, 0.01μF, +80%, –20%, 50V
C506, C546, C611	24692104	PF, 0.1μF, 50V
C507, C550, C630, C631, C634	24633470	EL, 47μF, 16V
C508	24631221	EL, 220μF, 6.3V
C509	24212681	CD, 680pF, ±10%, 50V
C510, C628, C635	24635479	EL, 4.7μF, 35V
C511, C522, C523, C526, C531, C540, C543, C616, C622, C623, C626, C629, C633	24633100	EL, 10μF, 16V
C512	24868333	PF, 0.033μF, ±10%, 50V
C514, C515	24692272	PF, 0.0027μF, 50V
C516	24692273	PF, 0.027μF, 50V
C517, C544, C604, C610, C613	24636010	EL, 1μF, 50V
C518, C525, C528, C549, C612	24633220	EL, 22μF, 16V
C519	24867102	PF, 0.001μF, 50V
C520	24598103	PF, 0.01μF, 50V
C521	24867103	PF, 0.01μF, 50V
C524, C529	24692823	PF, 0.082μF, 50V
C527	24692473	PF, 0.047μF, 50V
C530, C614	24636339	EL, 3.3μF, 50V
C532, C534	24353560	CD, 56pF
C533	24436151	CD, 150pF
C536, C538, C539	24085023	EL, 10μF, ±30%, 16V
C537, C606, C608	24692223	PF, 0.022μF
C542, C551	24632101	EL, 100μF, 10V
C545	24692103	PF, 0.01μF
C547, C601	24632221	EL, 220μF, 10V
C548	24633101	EL, 100μF, 16V
C552	24692184	PF, 0.18μF
C602, C603	24432101	CD, 100pF
C605, C607	24867392	PF, 0.0039μF
C609	24636229	EL, 2.2μF, 50V
C615	24632220	EL, 22μF, 10V

RESISTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R501, R572, RS22	24360105	CF, 1M ohm
R502, R516	24360512	CF, 5.1K ohm
R503, R594, R635	24360392	CF, 3.9K ohm
R504, R525, R588, R605, R606, R607, R618, R649, R690, R693, R694, R695, RS06	24360103	CF, 10K ohm
R505, R512, R529, R561	24360223	CF, 22K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R596, R643, R660, R678, R679, R684, RS02, RS13, RS14, RS16	24360223	CF, 22K ohm
R506, R539	24360272	CF, 2.7K ohm
R507, R519, R528, R571, R575, RS09, RS15, RS32	24360123	CF, 12K ohm
R508, R569, R577	24360822	CF, 8.2K ohm
R509, R511, R515, R582, RS04, RS18	24360563	CF, 56K ohm
R510	24360821	CF, 820 ohm
R513, R574, R578	24360562	CF, 5.6K ohm
R514, R527, R531, R545, R581, R671, R672, R675	24360153	CF, 15K ohm
R517, R530, R532, R533, R599	24360333	CF, 33K ohm
R518, RL95	24360622	CF, 6.2K ohm
R520, R573, R677, R683, R691	24360222	CF, 2.2K ohm
R521, R523, R536, R614, RL80, RL81, RS10	24360332	CF, 3.3K ohm
R522, R534, R540, R541, R542, R544, R562, R565, R566, R592, R647, R697, RS01, RS12	24360104	CF, 100K ohm
R524, R526, R547, R595, R612, R688, R689, R692	24360473	CF, 47K ohm
R535, R593	24360154	CF, 150K ohm
R537, R665	24360203	CF, 20K ohm
R538	24360163	CF, 16K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R543	24360753	CF, 75K ohm
R546	24360224	CF, 220K ohm
R548	24360560	CF, 56 ohm
R549, R598	24360514	CF, 510K ohm
R551, R552	71061334	VR, 470K ohm, 0.15W
R553	24061336	VR, 1M ohm, 0.15W
R554	71061328	VR, 47K ohm, 0.15W
R555	71061324	VR, 10K ohm, 0.15W
R563, R564	24378203	CF, 20K ohm, ±2%
R567, R580	24360393	CF, 39K ohm
R568	24360122	CF, 1.2K ohm
R570, R579, R587, RS03	24360183	CF, 18K ohm
R576, RL99	24360474	CF, 470K ohm
R584	24360124	CF, 120K ohm
R585	24378182	CF, 1.8K ohm, ±2%
R586	24378222	CF, 2.2K ohm, ±2%
R589, R590, R610, R617, R636, R687, R696, RS17, RS25	24360102	CF, 1K ohm
R591	24360431	CF, 430 ohm
R597	24360242	CF, 2.4K ohm
R601, R602, R603, R604, R613, R619, R623, R625, R626, R627, R628, R639, R640, R641, R667, R668, R669, R670, R673, R676, R682, R685, R686, R698, R699, RS34	24360472	CF, 4.7K ohm
R608, R611, R663, RL84	24360201	CF, 200 ohm
R609, R622, R624, R642, RL82, RL83	24360682	CF, 6.8K ohm
R615	24378681	CF, 680 ohm, ±2%
R616	24360121	CF, 120 ohm
R620	24360204	CF, 200K ohm
R621, RS07, RS08	24360101	CF, 100 ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R629, R634	24360471	CF, 470 ohm
R630, R631, R632, R633, R666, RL96	24360911	CF, 910 ohm
R637, R638	24941102	CC, 1K ohm, 1/4W
R644	24360202	CF, 2K ohm
R645	24524470	CC, 47 ohm, ±10%, 5W
R646	24360243	CF, 24K ohm
R651	24061146	VR, 100K ohm, 0.15W
R652, R653	71061134	VR, 1K ohm, 0.15W
R662	24380203	CF, 20K ohm
R674, RS36, RS39	24380153	CF, 15K ohm
R680	24380202	CF, 2K ohm
RL61, RL62	24941229	CC, 2.2 ohm, 1/4W
RL63	24380103	CF, 10K ohm
RL64	24380183	CF, 18K ohm
RL85	24360331	CF, 330 ohm
RL97	24378332	CF, 3.3K ohm, ±2%
RL98	24941681	CC, 680 ohm, 1/4W
RS05	24360433	CF, 43K ohm
RS11	24360303	CF, 30K ohm
RS19, RS33, RS35	24380223	CF, 22K ohm
RS20	24360684	CF, 680K ohm
RS21, RS26, RS27	24360824	CF, 820K ohm
RS23, RS24	24360511	CF, 510 ohm
RS28, RS29, RS31	24360823	CF, 82K ohm
RS30	24360164	CF, 160K ohm
RS37	24380224	CF, 220K ohm
RS38	24380823	CF, 82K ohm
SEMICONDUCTORS		
IC501	B0430810	IC, TM4217P, Digital
IC502	B0351500	IC, TA75902P, OP AMP
IC505	70135014	IC, TVH214, Hybrid, (Cue/Review)
IC601	B0403562	IC, TMP4320AP-6214
IC603	B0470016	IC, TC4001BP
IC604	B0274200	IC, TD62003P
IC605	70135001	IC, MC5223
IC504	B0311006	IC, TA7120P-B, Audio
IC602	B0470135	IC, TC4013BP, Dual
IC504	B0311016	IC, TA7120P-C, FA, Audio

LOCATION NUMBER	PART NUMBER	DESCRIPTION
IC602	70119149	C-MOS, IC, CD4013BE
IC504	B0311008	IC, TA7120P-D, Audio
Q503	A6317581	NPN, Transistor, 2SC1815NEW, B.L, F
Q506, Q512, Q514, Q515, Q521, Q525, Q532, Q611, Q612, Q613, Q614, Q615, Q616, Q619, Q632, Q633, Q634, Q635, Q636, Q637, Q638, Q639, Q655, Q656, Q657, Q659, Q660	A6534045	PNP, Transistor, 2SA1015-Y, FA
Q507, Q508, Q509, Q510, Q511, Q513, Q516, Q517, Q518, Q519, Q524, Q526, Q527, Q528, Q529, Q530, Q531, Q533, Q534, Q617, Q618, Q623, Q641, Q642, Q643, Q644, Q645, Q650, Q651, Q658, Q662	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
Q520	A6509141	PNP, Transistor, 2SA562TM-Y, FA
Q522	A6848520	NPN, Transistor, 2SD880-Y
Q523, Q648, Q649, Q652, Q653, Q654	A6533240	PNP, Transistor, 2SA966-Y
Q640	A6841900	NPN, Transistor, 2SD549
Q646	A6317567	NPN, Transistor, 2SC1815NEW, GR, F
Q647, Q661	A6325540	NPN, Transistor, 2SC2236-Y

LOCATION NUMBER	PART NUMBER	DESCRIPTION
Q629	A6326330	NPN, Transistor, 2SC2270-C
Q629	A6326320	NPN, Transistor, 2SC2270-B
D501, D502, D504, D505, D506, D507, D508, D509, D510, D511, D512, D513, D514, D515, D516, D517, D518, D519, D520, D521, D522, D523, D524, D525, D526, D527, D528, D529, D530, D531, D532, D533, D534, D535, D536, D537, D538, D601, D602, D603, D604, D606, D607, D608, D609, D611, D612, D616, D617, D633, D634, D635, D636, D638, D639, D640, D641	A7246711	Diode, 1S1555V
D624, D625, D626, D627, D628, D629, D630, D631	A7568521	Diode, 1S1885, FA
D503, D605	A7109362	Zener Diode, 05Z3.6-X
D503, D605	A7109363	Zener Diode, 05Z3.6-Y
D503, D605	70115109	Zener Diode, RD3.9EB2
COILS		
L501	70212011	Variable Inductor, TRF-7040

LOCATION NUMBER	PART NUMBER	DESCRIPTION
MISCELLANEOUS		
X501	70153029	Xtal, 2.986
S501	23145719	Switch, Slide, 2C2P
Z601, Z602	24000942	Resistor, Block, 4.7K ohm, ±20%, 1/8W
Z603	24000908	Resistor, Block, 6.8K ohm, ±20%, 1/8W
Z604	71000925	Resistor, Block, 100 ohm, ±20%, 1/8W
Z605	23153982	Ceramic - RESO, 455 kHz
P501, P504, P605, P606, P607	23164672	Plug, 3P, BLK
P502, P503, P507, P610, P614, P618	23164671	Plug, 3P, BRN
P505	23164669	Plug, 4P, BLK
P506, P608	23164665	Plug, 5P, BRN
P508, P609	23164673	Plug, 3P, WHT
P509	23164658	Plug, 9P, BRN
P510, P623	23162043	Terminal
P601, P616	23164659	Plug, 8P, BRN
P602	23164653	Plug, 14P, BRN
P603	23164663	Plug, 6P, BLK
P604	23164666	Plug, 5P, BLK
P611	23164662	Plug, 6P, BRN
P612	23164655	Plug, 12P, BRN
P613	23164660	Plug, 7P, BRN
P615	23164668	Plug, 4P, BRN

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LOCATION NUMBER	PART NUMBER	DESCRIPTION
CAPACITORS		
C617, C618, C620	24632220	EL, 22μF, 10V
C619, C621	24633100	EL, 10μF, 16V
RESISTORS		
RL66, RL67, RL68, RL69, RL86, RL87, RL88, RL89	24941271	CC, 270 ohm, 1/4W
RL70, RL72, RL73	24380332	CF, 3.3K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
RL71, RL78	24360332	CF, 3.3K ohm
RL74, RL75, RL77	24380622	CF, 6.2K ohm
RL76	24380682	CF, 6.8K ohm
RL79	24360682	CF, 6.8K ohm

SEMICONDUCTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
Q620, Q621, Q622, Q624, Q625	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
Q626, Q627, Q628, Q630, Q631	A6326330	NPN, Transistor, 2SC2270-C
Q626, Q627, Q628, Q630, Q631	A6326320	NPN, Transistor, 2SC2270-B
D613, D614, D615, D618, D619	A7246711	Diode, 1S1555V
D620, D621, D622, D623, D632	A7568521	Diode, 1S1885, FA

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CAPACITORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
C701, C718, C726, C732, C744, C765	24635479	EL, 4.7μF, 35V
C702	24436151	CD, 150pF
C703, C704, C766	24633221	EL, 220μF, 16V
C705, C741, C761	24636478	EL, 0.47μF, 50V
C706, C738, C764	24867103	PF, 0.01μF
C707, C733, C737, C739, C740, C743, C748, C762	24633100	EL, 10μF, 16V
C708, C734	24867562	PF, 0.0056μF
C709, C767, C768, C770	24633101	EL, 100μF, 16V
C710, C712, C773	24436241	CD, 240pF
C711	24436911	CD, 910pF
C713, C769	24633470	EL, 47μF, 16V
C714	24212332	CD, 0.0033μF, ±10%
C715, C721	24867153	PF, 0.015μF
C716	24214221	CD, 220pF, ±10%, 500V
C717, C720	24867333	PF, 0.033μF
C719	24867823	PF, 0.082μF
C722	24436561	CD, 560pF
C725	24692472	PF, 0.0047μF
C727	24212102	CD, 0.001μF, ±10%
C728	24436470	CD, 47pF
C729, C731, C745	24633220	EL, 22μF, 16V
C730	24631221	EL, 220μF, 6.3V
C735	24867393	PF, 0.039μF
C736	24436471	CD, 470pF
C742	24867104	PF, 0.1μF
C746	24436510	CD, 51pF
C747, C749	24636010	EL, 1μF, 50V
C763	24436681	CD, 680pF
C772	24867152	PF, 0.0015μF

RESISTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R701	24380154	CF, 150K ohm
R702	24380100	CF, 10 ohm
R703, R705, R713, R724, R732, R744, R747, R789, R797	24380103	CF, 10K ohm
R704, R718, R745, R771	24380222	CF, 2.2K ohm
R706	24380474	CF, 470K ohm
R707	24380201	CF, 200 ohm
R708	24380274	CF, 270K ohm
R709	24380223	CF, 22K ohm
R710	24380302	CF, 3K ohm
R711	24380202	CF, 2K ohm
R712	24380153	CF, 15K ohm
R714	24380334	CF, 330K ohm
R715, R722, R763, R767	24380562	CF, 5.6K ohm
R716, R788	24380272	CF, 2.7K ohm
R717, R748	24380102	CF, 1K ohm
R720, R733	24380472	CF, 4.7K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R736, R741, R742, R777, R787, R792	24380472	CF, 4.7K ohm
R721, R769, R778	24380332	CF, 3.3K ohm
R723, R735, R738	24380333	CF, 33K ohm
R725, R780	24380273	CF, 27K ohm
⚠R726	24556479	Fusible, 4.7 ohm, ±10%, 1/2W
R727, R772, R783	24380104	CF, 100K ohm
R728, R785	24380473	CF, 47K ohm
R729	24380101	CF, 100 ohm
R730	24941229	CC, 2.2 ohm, 1/4W
R731	24360272	CF, 2.7K ohm
R734	24380563	CF, 56K ohm
R737	24380681	CF, 680 ohm
R739, R791	24380203	CF, 20K ohm
R740	24380683	CF, 68K ohm
R743, R746, R782	24380433	CF, 43K ohm
R749	24380331	CF, 330 ohm
R751, R757	24061142	VR, 22K ohm, 0.15W
R752	24061138	VR, 4.7K ohm, 0.15W
R753	24061148	VR, 220K ohm, 0.15W
R754	24061432	Metal, VR, 100K ohm, 1/2W
R755	24061140	VR, 10K ohm, 0.15W
R756	24061137	VR, 3.3K ohm, 0.15W
R760	24398303	CF, 30K ohm, ±2%
R761	24398563	CF, 56K ohm, ±2%
R762	24360333	CF, 33K ohm
R764, R768	24398153	CF, 15K ohm, ±2%
R765	24398471	CF, 470 ohm, ±2%
R766	24380822	CF, 8.2K ohm
R770, R776	24398333	CF, 33K ohm, ±2%
R773	24360104	CF, 100K ohm
R774	24380105	CF, 1M ohm
R775	24360563	CF, 56K ohm
R779	24380392	CF, 3.9K ohm
R781	24380683	CF, 68K ohm
R784	24360623	CF, 62K ohm
R786	24380124	CF, 120K ohm
R790, R794	24360472	CF, 4.7K ohm
R793	24360103	CF, 10K ohm
R795	24398472	CF, 4.7K ohm, ±2%

LOCATION NUMBER	PART NUMBER	DESCRIPTION
R796	24380912	CF, 9.1K ohm
SEMICONDUCTORS		
IC702	B0356520	IC, TA7652P, Audio
IC701	B0311006	IC, TA7120P-B, Audio
IC701	B0311016	IC, TA7120P-C, Audio
IC701	B0311008	IC, TA7120P-D, Audio
Q704, Q706, Q707	A6325825	NPN, Transistor, 2SC2240NEW, GR
Q705	A6041880	FET, 2SK117-BL
Q708	A6533625	PNP, Transistor, 2SA970NEW, GR
Q709, Q710	A6319302	NPN, Transistor, 2SC1959NEW-Y, FA
Q703, Q712, Q713, Q714, Q715, Q716, Q718, Q719	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
Q711, Q717	A6534045	PNP, Transistor, 2SA1015-Y, FA
Q703, Q712, Q713, Q714, Q715, Q716, Q718, Q719	A6317526	NPN, Transistor, 2SC1815NEW, O, FA
Q711, Q717	A6534021	PNP, Transistor, 2SA1015-O, FA
D701, D702, D703, D704, D705, D706, D707, D708, D709, D710, D711, D712	A7246711	Diode, 1S1555V
COIL & TRANSFORMER		
L701	23221987	Coil, CSL1213, Choke
L702	23283221	Coil, TRF4221JG, Peaking
T701	23254984	Transformer, TRF7005
MISCELLANEOUS		
Z701	70212017	Low Pass Filter
Z702	70212018	Low Pass Filter

LOCATION NUMBER	PART NUMBER	DESCRIPTION
LINE FILTER UNIT 70191551		
CAPACITORS		
C801	24098011	MP, CAP99X, 0.1μF, ±20%, AC250V
C811	24636221	EL, 220μF, 50V
C812	24641221	EL, 220μF, 100V
C813	24641100	EL, 10μF, 100V
C814	24641220	EL, 22μF, 100V
C815	24636101	EL, 100μF, 50V
C816	24636479	EL, 4.7μF, 50V
C817	24636100	EL, 10μF, 50V
RESISTORS		
R811	24964362	OMF, 3.6K ohm, 2W
R812	24941471	CC, 470 ohm, 1/4W
R813	24360332	CF, 3.3K ohm
R814	24360682	CF, 6.8K ohm
R815	24964122	OMF, 1.2K ohm, 2W
⚠R816	24531150	Fusible, 15 ohm, 1/2W
R821	24360123	CF, 12K ohm
R822, R823	24982399	Metal, 3.9 ohm, 1/2W
SEMICONDUCTORS		
Q811	A6841475	NPN, Transistor, 2SD525Y
Q812	A6314446	NPN, Transistor, 2SC1627-Y, FA
Q813	A6534045	PNP, Transistor, 2SA1015-Y, FA
D811, D812, D813, D818	A7568521	Diode, 1S1885, FA
D816, D817, D821, D823, D824, D825	A7246711	Diode, 1S1555V, TV
D822	A7109360	Zener Diode, 05Z3.6
D814, D815	A7110652	Zener Diode, 05Z24-L
D819	A7110646	Zener Diode, 05Z22-Y
D814, D815	A7110663	Zener Diode, 05Z24-X
TRANSFORMER		
T801	23211984	Coil, TRF3015, Line Filter

LOCATION NUMBER	PART NUMBER	DESCRIPTION
MISCELLANEOUS		
⚠F801	23144964	Fuse, 800MA
P812	23164788	Plug, 8P
P813	23164786	Plug, 6P
P814	23164783	Plug, 3P
P815	23162043	Terminal
POWER UNIT 70191552		
CAPACITORS		
C831	70415064	EL, 0.01μF, 35V
C832	24636100	EL, 10μF, 50V
C833	24232103	CD, 0.01μF, +80%, −20%, 50V
C834, C835	24634470	EL, 47μF, 25V
C836	24633100	EL, 10μF, 16V
C837	24633470	EL, 47μF, 16V
C838	24635100	EL, 10μF, 35V
C839	24634220	EL, 22μF, 25V
C841, C842, C843, C844	24232473	CD, 0.047μF, +80%, −20%, 50V
RESISTORS		
R831	24962103	OMF, 10K ohm, 1/2W
R832, R834	24360102	CF, 1K ohm
R833	24360393	CF, 39K ohm
R835, R836	24360152	CF, 1.5K ohm
R837	24962471	OMF, 470 ohm, 1/2W
R838	24963561	OMF, 560 ohm, 1W
⚠R839	24531220	Fusible, 22 ohm, 1/2W
⚠R840	24546829	Fusible, 8.2 ohm, 1/2W
R841	24360332	CF, 3.3K ohm
R842	24360682	CF, 6.8K ohm
R843	24360472	CF, 4.7K ohm
R844	24962152	OMF, 1.5K ohm, 1/2W
R845, R847	24360223	CF, 22K ohm
R846	24360392	CF, 3.9K ohm
R848	24360363	CF, 36K ohm
R851	71061135	VR, 1K ohm, 0.15W
SEMICONDUCTORS		
Q838, Q842, Q843	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA

LOCATION NUMBER	PART NUMBER	DESCRIPTION
Q839	A6848510	NPN, Transistor, 2SD880-O
Q841	A650246A	PNP, Transistor, 2SA496-Y, X
⚠D831	70115105	Rectifier Bridge, S5VB10F
⚠D833, D841, D842, D843	A7246711	Diode, 1S1555V
D834	A7286107	Zener Diode, 02Z6.2A
D835	A7285900	Zener Diode, 02Z5.6A
D836	A7110402	Zener Diode, 05Z12-U
D836	A7110160	Zener Diode, 05Z7.5-Y
D837	A7110040	Zener Diode, 05Z5.1-X
D836	A7110161	Zener Diode, 05Z7.5-Z
D837	A7110041	Zener Diode, 05Z5.1-Y

MISCELLANEOUS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
⚠F831, F832	23144904	Fuse, 2.5AT, F2.5I1T
⚠F831A, F832A	23165102	Fuse Holder
P831	23164966	Plug, 3P
P832	23164658	Plug, 9P, BRN
P833	23164666	Plug, 5P, BLK
P834	23164660	Plug, 7P, BRN
P835	23164663	Plug, 6P, BLK
P836	23164665	Plug, 5P, BRN
P837	23164662	Plug, 6P, BRN
P838	23162043	Terminal

POWER DRIVE UNIT 70191553

SEMICONDUCTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
Q831	A6848402	NPN, Transistor, 2SD878, FA-1
Q832	A6841490	NPN, Transistor, 2SD525-O
Q834	A6317526	NPN, Transistor, 2SC1815NEW, O, FA
Q835	A671656A	NPN, Transistor, 2SC495-Y, X
Q836	A6314426	NPN, Transistor, 2SC1627-O, FA
Q837	A6848520	NPN, Transistor, 2SD880-Y
Q832B, Q837B	23850904	Washer
Q832D, Q837D	23740016	Nut, N2.6SZN
D838, D839	A7246711	Diode, 1S1555V, TV

LOGIC CONT UNIT 70191554

CAPACITORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CL01	24632470	EL, 47μF, 10V
CL02	24636478	EL, 0.47μF, 50V
CR11	24636010	EL, 1μF, 50V

RESISTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
RL01, RL02, RL03, RL04, RL05, RL08, RL09	24360201	CF, 200 ohm
RL06	24360510	CF, 51 ohm
RL07, RL26	24380201	CF, 200 ohm
RL10, RL12, RL13, RL16, RL22	24360472	CF, 4.7K ohm
RL11, RL15	24360103	CF, 10K ohm
RL14	24380472	CF, 4.7K ohm
RL17, RL18, RR21	24360223	CF, 22K ohm
RL19	24360104	CF, 100K ohm
RL20, RR20	24360102	CF, 1K ohm
RL21	24360101	CF, 100 ohm
RL23	24360302	CF, 3K ohm
RL30	24360182	CF, 1.8K ohm
RL51	24060558	VR, 500K ohm, 1/5W
RR22, RR23, RR24, RR25	24380103	CF, 10K ohm

SEMICONDUCTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
ICL01	70119158	IC, SN7442AN, TTL BCD
ICL02	70135015	IC, TVH202, Logic TVH202
Q01, Q02, Q03, Q04, Q05, Q06, Q07, Q08, Q09	A6541130	PNP, Transistor, 2SA1162-Y
Q10	A6335470	NPN, Transistor, 2SC2712-Y
QL03, QL05, QL06	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA

LOCATION NUMBER	PART NUMBER	DESCRIPTION
QL04, QR03	A6534045	PNP, Transistor, 2SA1015-Y, FA
DL01, DL02, DL04, DL05, DL08, DL09, DL10, DL14	A8605666	LED, TLG113A
DL03, DL06, DL07, DL11, DL13	A8600607	LED, TLR113A
DL20, DL21, DL22, DL23, DL24, DL25, DL26, DL27, DL28, DL29, DL30, DL31, DL32, DL33, DL34, DL35, DL36, DL37, DL38, DL39, DL40, DL41, DL42, DL49, DR01, DR02, DR03, DR04	A7246711	Diode, 1S1555V, TV

MISCELLANEOUS

SL01, SL02, SL03, SL04, SL05, SL06, SL07, SL08, SL09, SL10	23145763	Switch, Push, 1C1P
SL11	70145109	Key Board, Switch, 1C1P, KEC10903
PL01	23164665	Plug, 5P, BRN
PL02	23164655	Plug, 12P, BRN
PL03	23164659	Plug, 8P, BRN
PL04, PL06	23164673	Plug, 3P, WHT
PL05, PL08	23164671	Plug, 3P, BRN

TIMER DISP UNIT 70191555

CAPACITORS

CX01	24636478	EL, 0.47μF, 50V
CX02, CX06	24232103	CD, 0.01μF, +80%, −20%, 50V
CX03	24436221	CD, 220pF

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CX04, CX08	24436331	CD, 330pF
CX05	24636010	EL, 1μF, 50V
CX07	70435019	EL, 0.1μF, 50V
CX09	24232473	CD, 0.047μF, +80%, −20%, 50V

RESISTORS

RX01	24380132	CF, 1.3K ohm
RX02	24380911	CF, 910 ohm
RX03	24380102	CF, 1K ohm
RX04, RX15, RX16	24380103	CF, 10K ohm
RX05	24380912	CF, 9.1K ohm
RX06	24360223	CF, 22K ohm
RX07	24380123	CF, 12K ohm
RX08	24380473	CF, 47K ohm
RX09	24380224	CF, 220K ohm
RX10	24380392	CF, 3.9K ohm
RX11	24380101	CF, 100 ohm
RX12, RX13	24380823	CF, 82K ohm
RX14	24380561	CF, 560 ohm
RX17	24360392	CF,, 3.9K ohm
RX18	24380223	CF, 22K ohm
RX19	24941681	CC, 680 ohm, 1/4W

SEMICONDUCTORS

QX01	70135007	IC, TMS1370N2LHL, Micon
QX02, QX04, QX06, QX07	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
QX03, QX05	A6534045	PNP, Transistor, 2SA1015-Y, FA
DX02, DX03, DX04, DX05, DX06	A7246711	Diode, 1S1555V, TV
DX07, DX08, DX13, DX14	A8605666	LED, TLG113A
DX01	A7110103	Zener Diode, 05Z6.8-U
DX09, DX11	A7109305	Zener Diode, 05Z3.0-Z
DX01	A7110116	Zener Diode, 05Z6.8-Z
DX09, DX11	A7109332	Zener Diode, 05Z3.3-X
DX09, DX11	70115154	Zener Dioder, RD3.6EB1

LOCATION NUMBER	PART NUMBER	DESCRIPTION
MISCELLANEOUS		
SX01	23145717	Switch, Push, 3P, 2C1P
ZX01	70153028	Ceramic Resonator, 400 kHz
ZX02	70427008	Resistor, Block, 82K ohm, ±10%, 1/8W
ZX03, ZX04	70427006	Resistor, Block, 82K ohm, ±10%, 1/8W
ZX05	70427005	Resistor, Block, 82K ohm, ±10%, 1/8W
GX01	70113027	FL, Display, FIP, 8AM10
PX01	70165090	Plug, 10P, BRN
PX02	70165123	Plug, 3P, BLK
PX03	70165083	Plug, 3P, BRN
PX04	23162043	Terminal

TIMER SET UNIT 70191575

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CAPACITORS		
CX61	70432220	EL, 22μF, 16V
RESISTORS		
RX61, RX69	24360152	CF, 1.5K ohm
RX62, RX63, RX64	24360823	CF, 82K ohm
RX65	24360103	CF, 10K ohm
RX66, RX67	24360223	CF, 22K ohm
RX68	24360153	CF, 15K ohm
SEMICONDUCTORS		
QX61, QX62	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
DX61, DX62, DX63, DX64, DX65, DX66, DX67, DX68, DX69	A7246711	Diode, 1S1555V, TV
DX70	A8600650	LED, TRL114
MISCELLANEOUS		
SX61, SX62, SX63	70145123	Switch, Push, 1C1P
SX64, SX65	70145122	Switch, Slide, 2C3P
VX61	70818034	Holder, Timer Setting

SERVO II UNIT 70191556

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CAPACITORS		
CY01	24692473	PF, 0.047μF
CY02	24617998	EL, 1μF, ±10%, 50V
CY03	24617996	EL, 3.3μF, ±10%, 50V
CY04, CY05	24692154	PF, 0.15μF
CY06	24692223	PF, 0.022μF
CY07, CY15, CY24	24232103	CD, 0.01μF, +80%, −20%, 50V
CY08	24636010	EL, 1μF, 50V
CY09	24636229	EL, 2.2μF, 50V
CY10	24692273	PF, 0.027μF
CY11, CY12	24212102	CD, 0.001μF, ±10%, 50V
CY13	24692393	PF, 0.039μF
CY14	24633100	EL, 10μF, 16V
CY16	24692103	PF, 0.01μF
CY21, CY23	24633470	EL, 47μF, 16V
RESISTORS		
RY01	24380153	CF, 15K ohm
RY06, RY32, RY37, RY46, RY48	24380104	CF, 100K ohm
RY07	24380103	CF, 10K ohm
RY08, RY22, RY33, RY38	24360103	CF, 10K ohm
RY09, RY10, RY27, RY29, RY63	24380203	CF, 20K ohm
RY11, RY67	24380332	CF, 3.3K ohm
RY12	24380394	CF, 390K ohm
RY17	24360224	CF, 220K ohm
RY18, RY49, RY61, RY92, RY95	24380204	CF, 200K ohm
RY19, RY24	24380334	CF, 330K ohm
RY20, RY41	24360473	CF, 47K ohm
RY21, RY28	24380333	CF, 33K ohm
RY23, RY90	24360204	CF, 200K ohm
RY25, RY77	24360333	CF, 33K ohm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
RY26	24380434	CF, 430K ohm
RY30, RY65, RY76, RY79, RY94	24360203	CF, 20K ohm
RY31, RY35	24360683	CF, 68K ohm
RY34	24360104	CF, 100K ohm
RY36, RY88	24380474	CF, 470K ohm
RY39	24360472	CF, 4.7K ohm
RY43	24380563	CF, 56K ohm
RY44	24380304	CF, 300K ohm
RY45	24380393	CF, 39K ohm
RY47	24380823	CF, 82K ohm
RY50, RY53, RY57, RY58	24061336	VR, 1M ohm, 0.15W
RY51, RY55	24061334	VR, 470K ohm, 0.15W
RY59	24061318	VR, 1K ohm, 0.15W
RY60	24360393	CF, 39K ohm
RY62, RY80	24380154	CF, 150K ohm
RY64, RY66, RY86, RY87	24360102	CF, 1K ohm
RY71	24380272	CF, 2.7K ohm
RY72, RY85	24380821	CF, 820 ohm
RY75, RY78	24381391	OMF, 390 ohm, 1/2W
RY81	24380564	CF, 560K ohm
RY84	24941100	CC, 10 ohm, 1/4W
RY91, RY93, RY96	24380134	CF, 130K ohm
RY97	24380911	CF, 910 ohm
RY98	24380913	CF, 91K ohm
RY99	24360152	CF, 1.5K ohm

SEMICONDUCTORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
ICY01, ICY03	B0475282	IC, TC4528BP
ICY02	70119170	IC, MC14538BCP
ICY04, ICY05	B0470135	IC, TC4013BP, Dual
QY06, QY10, QY14, QY15, QY16, QY20, QY31, QY09	A6534045	PNP, Transisotr, 2SA1015-Y, FA
QY07, QY26, QY27, QY30, QY13	A6317547	NPN, Transistor, 2SC1815NEW, Y, FA
QY18, QY19, QY22, QY24	A6317581	NPN, Transistor, 2SC1815NEW, BL, F
QY23, QY25	A6326320	NPN, Transistor, 2SC2270-B
QY09	A6534021	PNP, Transistor, 2SA1015-O, FA
QY13	A6317526	NPN, Transistor, 2SC1815NEW, O, FA
DY02, DY03, DY04, DY05, DY06, DY07, DY08, DY09, DY10, DY11, DY12, DY15, DY16, DY17, DY18, DY19, DY20, DY21, DY22, DY23, DY25, DY26, DY27, DY28, DY29, DY38, DY39, DY41, DY42	A7246711	Diode, 1S1555V
DY32, DY34, DY35, DY36	A7568521	Diode, 1S1885

MISCELLANEOUS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
PY01, PY07	23164671	Plug, 3P, BRN
PY02	23164673	Plug, 3P, WHT
PY04, PY10	23164672	Plug, 3P, BLK
PY05	23164666	Plug, 5P, BLK
PY06, PY08	23164660	Plug, 7P, BRN
PY09	23162043	Terminal

CAPSTAN DRIVE PW2470 UNIT 70191469

CAPACITORS

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CY32, CY33	24232103	CD, 0.01μF, +80%, −20%, 50V

LOCATION NUMBER	PART NUMBER	DESCRIPTION
SEMICONDUCTORS		
QY32, QY33	A6844100	NPN, Transistor, 2SD686, Darlington
QY34	A6610260	PNP, Transistor, 2SB435-Y, Z

REMOCON PWB VC-86

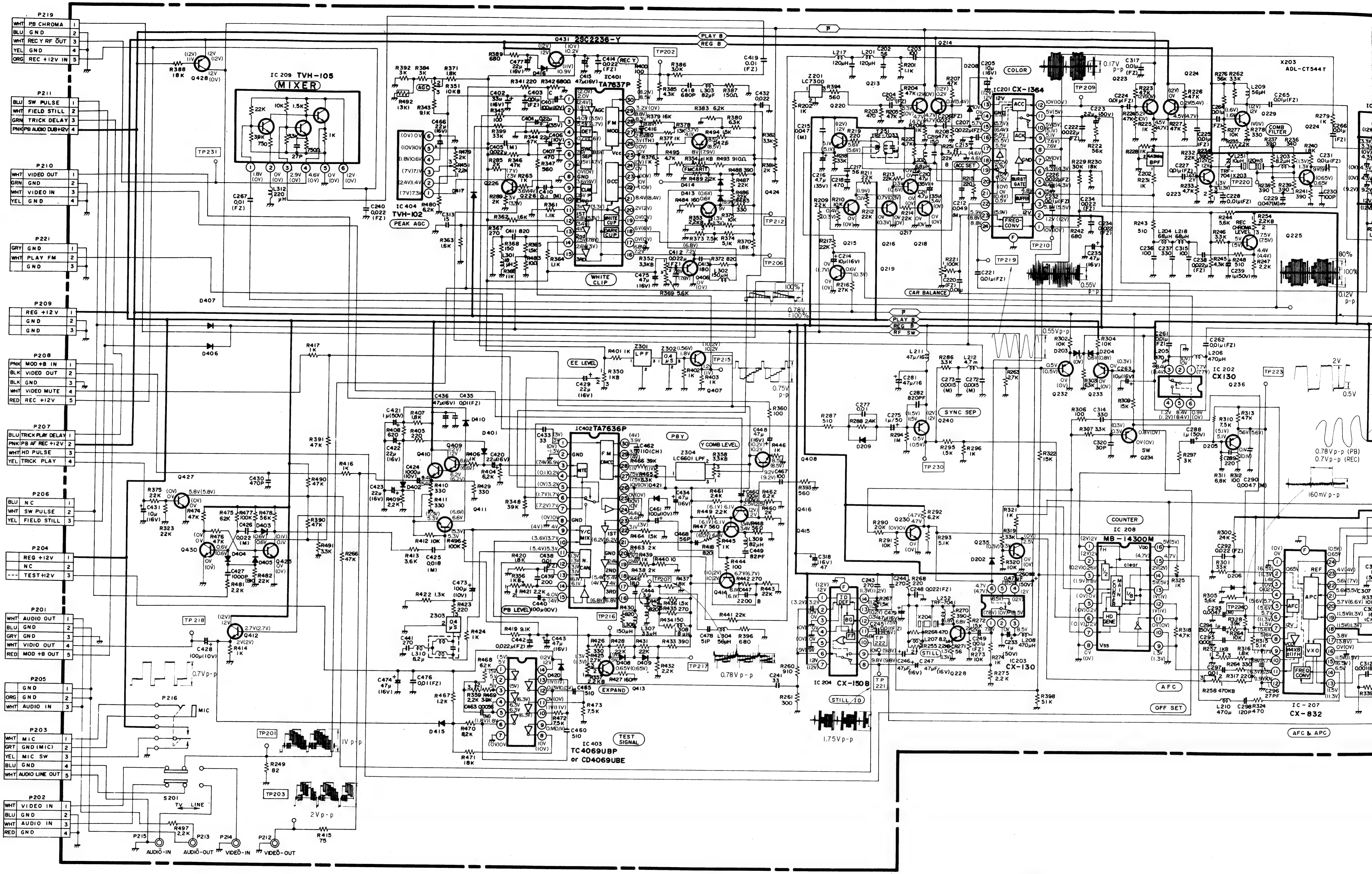
LOCATION NUMBER	PART NUMBER	DESCRIPTION
CAPACITORS		
CR01	24632470	EL, 47μF, 10V
CR02	24232103	CD, 0.01μF, +80%, –20%, 50V
RESISTORS		
RR01, RR02, RR03, RR04, RR05, RR06, RR07, RR15	24360103	CF, 10K ohm
RR08, RR09, RR10, RR11, RR12, RR13, RR14	24360104	CF, 100K ohm
RR51	70421130	VR, 1M ohm, 0.2W, Slide
RR52	70421131	VR, 500K ohm, Metal 0.05W
SEMICONDUCTORS		
ICR02	B0470016	IC, TC4001BP
ICR01	B0475322	CMOS, IC, TC4532BP
ICR01	70119162	CMOS, IC, CD4532BE
MISCELLANEOUS		
SR01, SR02, SR03, SR04, SR05, SR06, SR07	70145124	Switch, Push, 1C1P

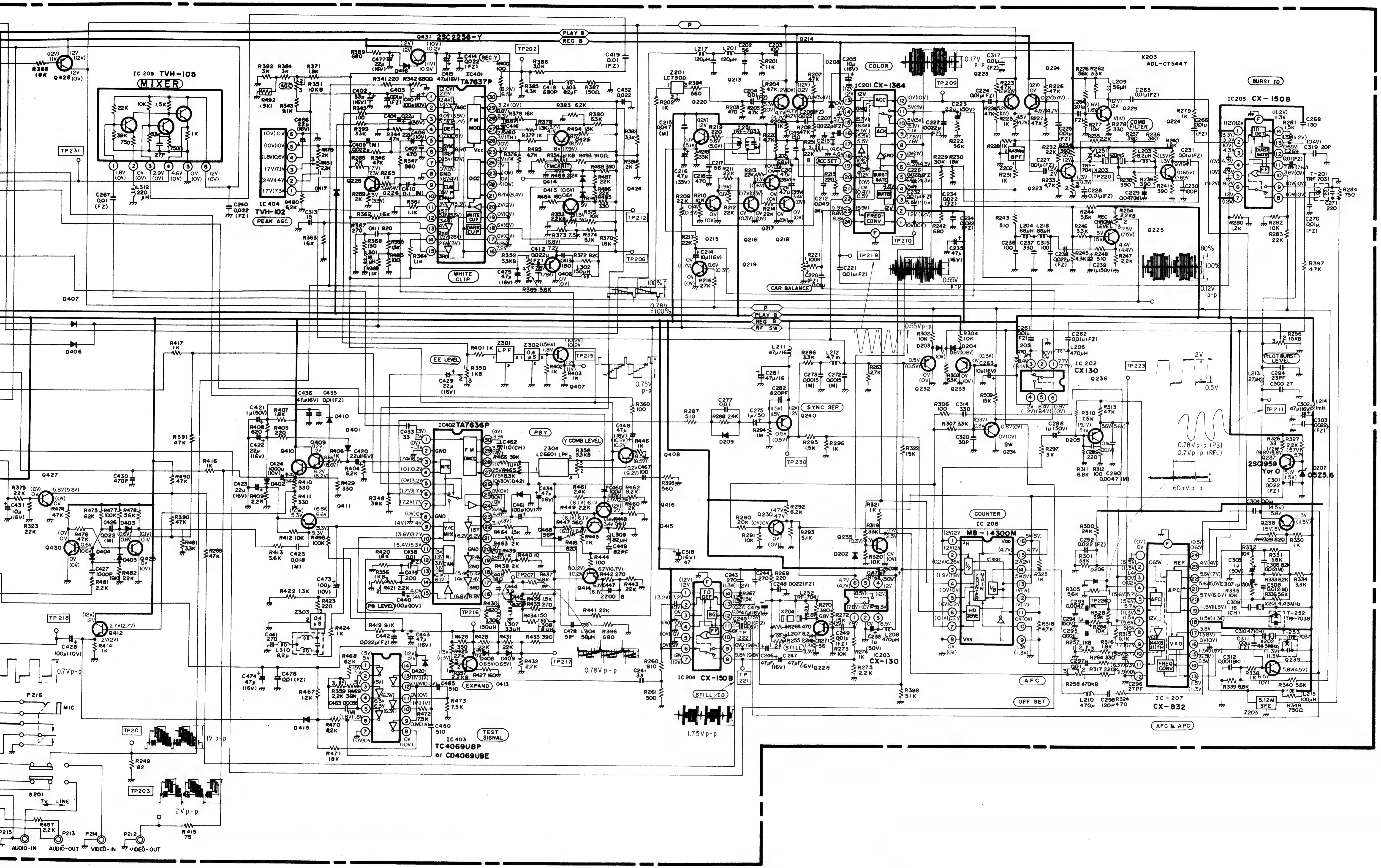
OVER ALL

LOCATION NUMBER	PART NUMBER	DESCRIPTION
CAPACITORS		
CY32, CY33	24232103	CD, 0.01μF, +80%, –20%, 50V
C691, C692	24094554	CD, 0.001μF, S
TRANSFORMER		
T802	70213028	Power Trans, TPW1191
MISCELLANEOUS		
S652	23145799	Switch, Push, 1C2P
S801	23145778	Switch, Seesaw, 2C2P
P651	70163034	2.5MM, Jack, J2501
P811	23176319	2P Cord, UK2.2M, 250V, Powercord, 2.5A
PR91	23116663	Terminal, 8P, Remocon
M002E	70125074	Capstan Motor, DM-4904T
H003	70142025	VT-605, Antenna Terminal Board assy
H004	70123041	RF Unit, MD5536
H005	70142026	Booster, BSWE35

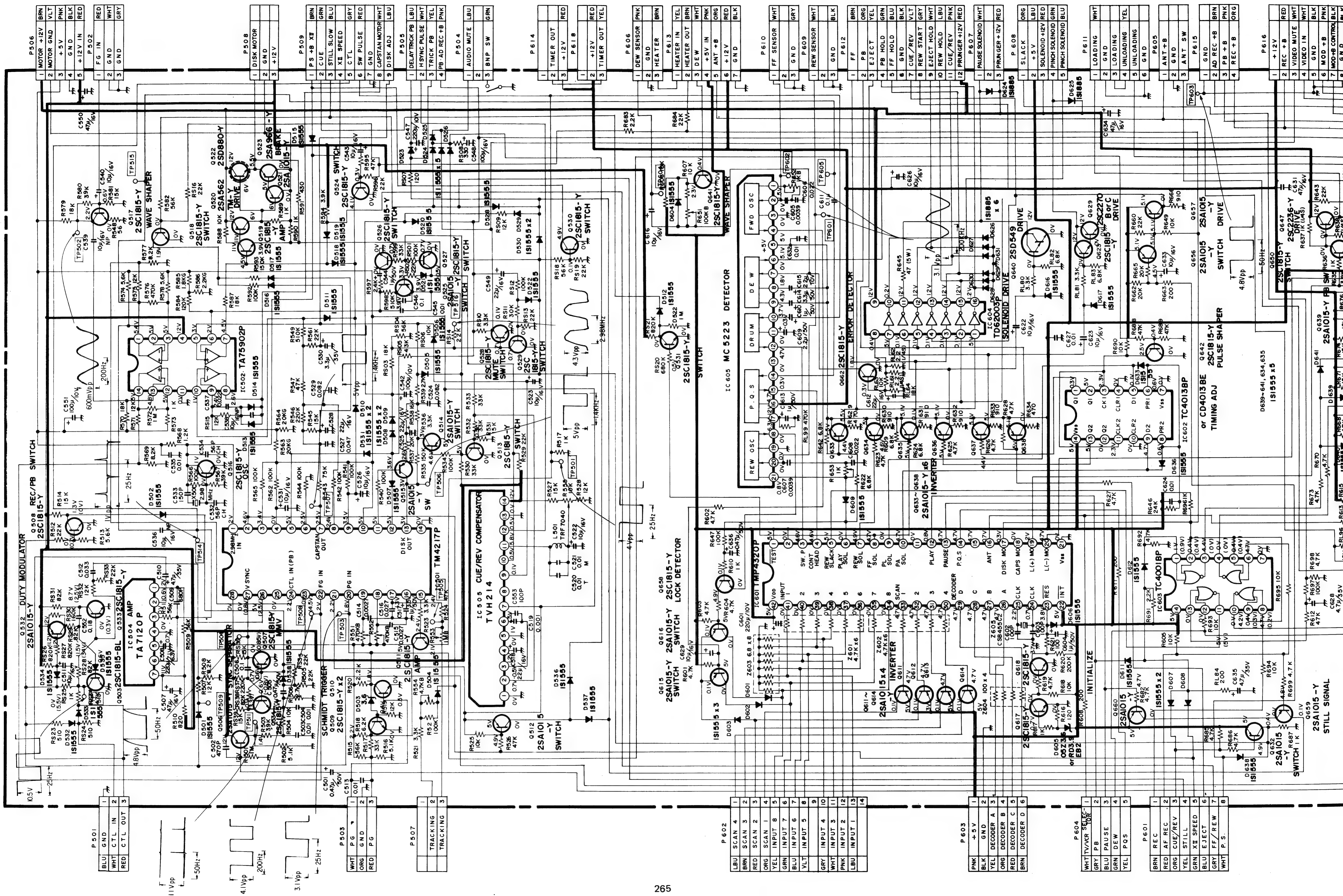
SECTION 8 SCHEMATIC DIAGRAMS

1. VIDEO CIRCUIT

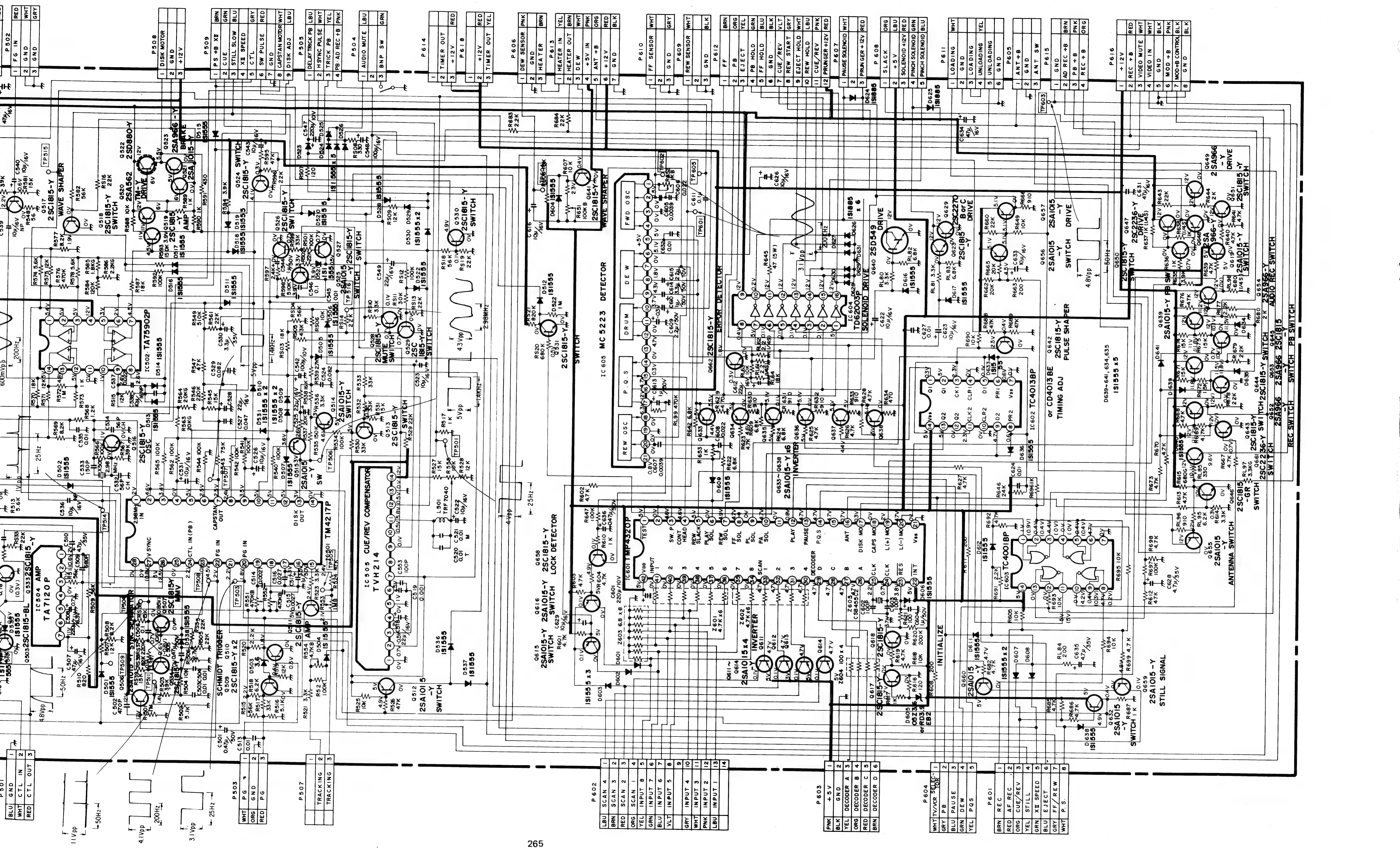



IC 209 TVH-105
MIXER
IC 404 TVH-102
PEAK AGC
Q431 2SC2236-Y
IC401 TA7637P
WHITE CLIP
IC201 CX-1364
COLOR
CAR BALANCE
IC205 CX-150B
BURST ID
X203 ADL-CT544T
COMB FILTER
IC402 TA7636P
PBY
Y COMB LEVEL
EE LEVEL
PB LEVEL
IC 403 TC4069UBP or CD4069UBE
EXPAND
TEST SIGNAL
IC 204 CX-150B
STILL ID
SYNC SEP
IC 202 CX130
PILOT BURST LEVEL
COUNTER
IC 208 MB-14300M
AFC
OFF SET
IC203 CX-130
IC-207 CX-832
AFC & APC
MIC
S201
TV LINE
AUDIO-IN
AUDIO-OUT
VIDEO-IN
VIDEO-OUT

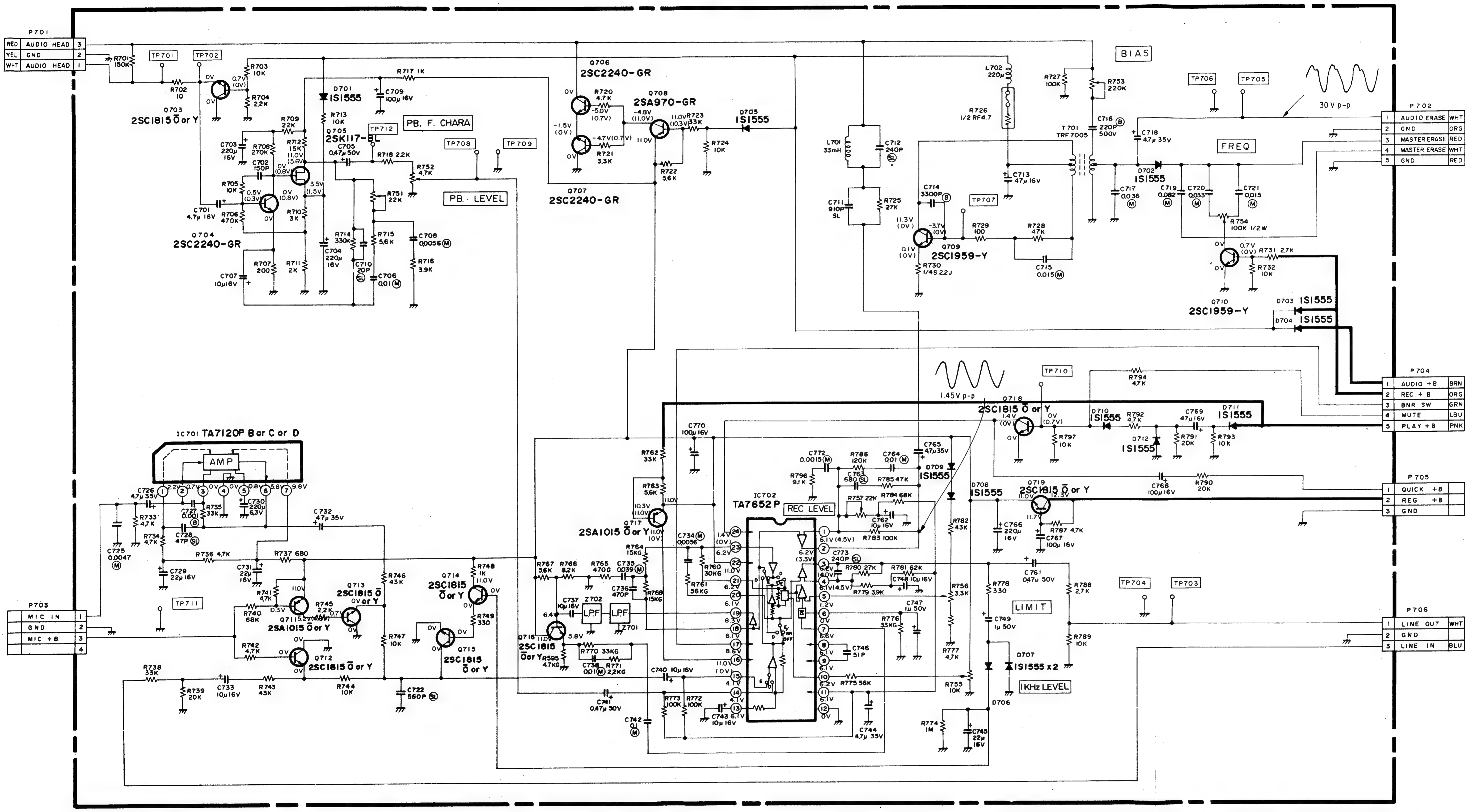
2. SERVO/LOGIC CIRCUIT



GIC CIRCUIT

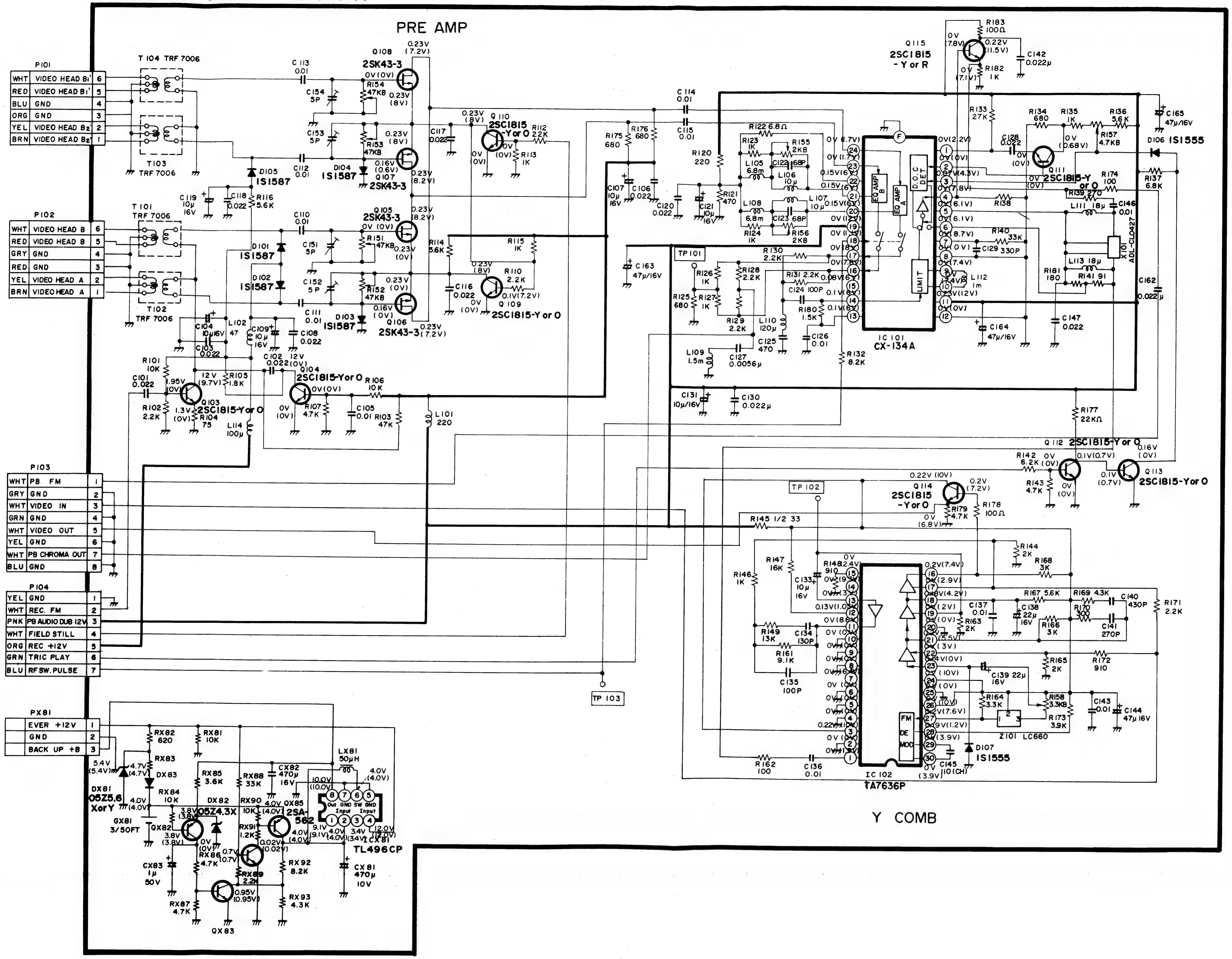


3. AUDIO CIRCUIT

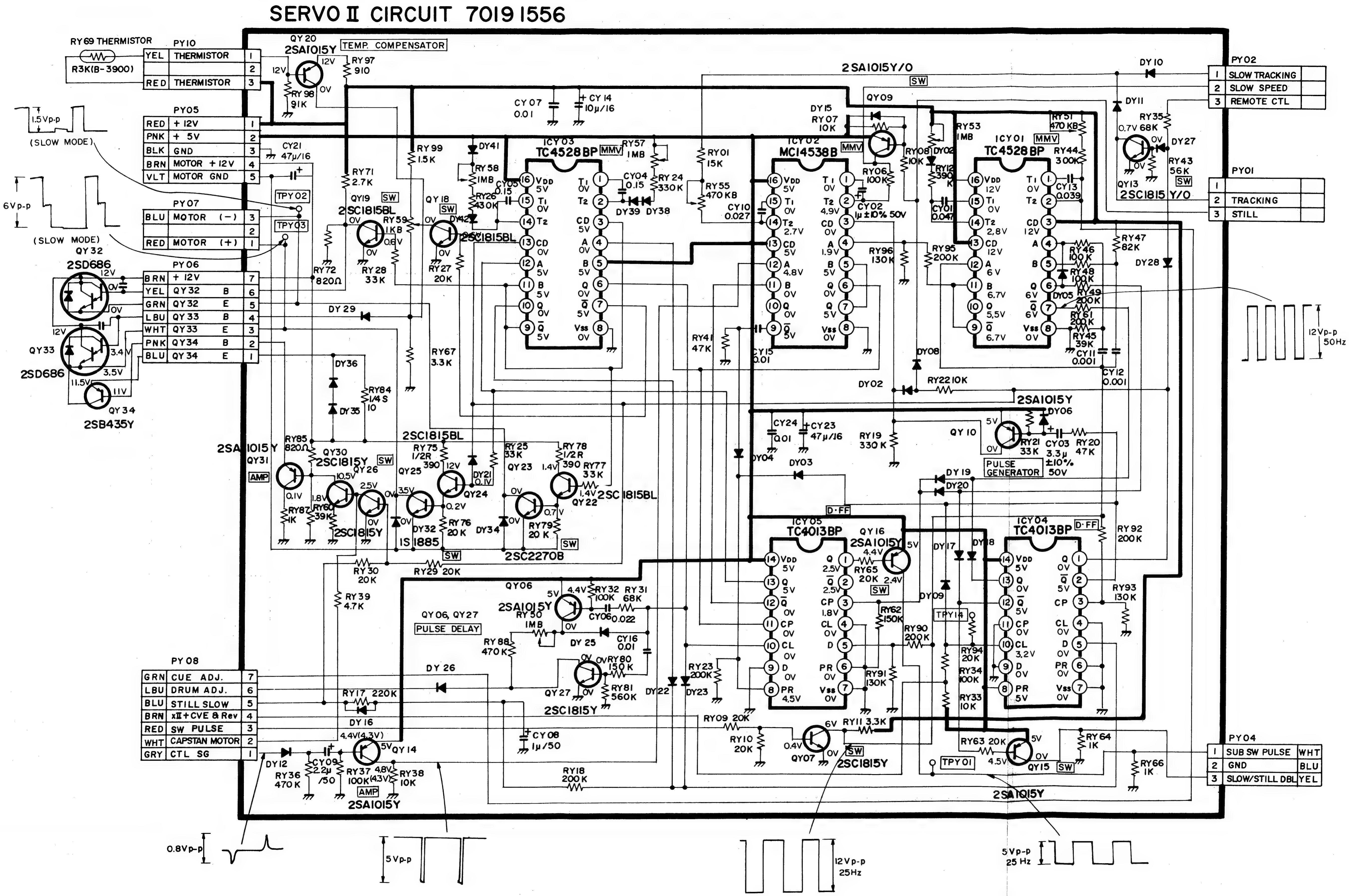


4. VIDEO PRE AMP CIRCUIT

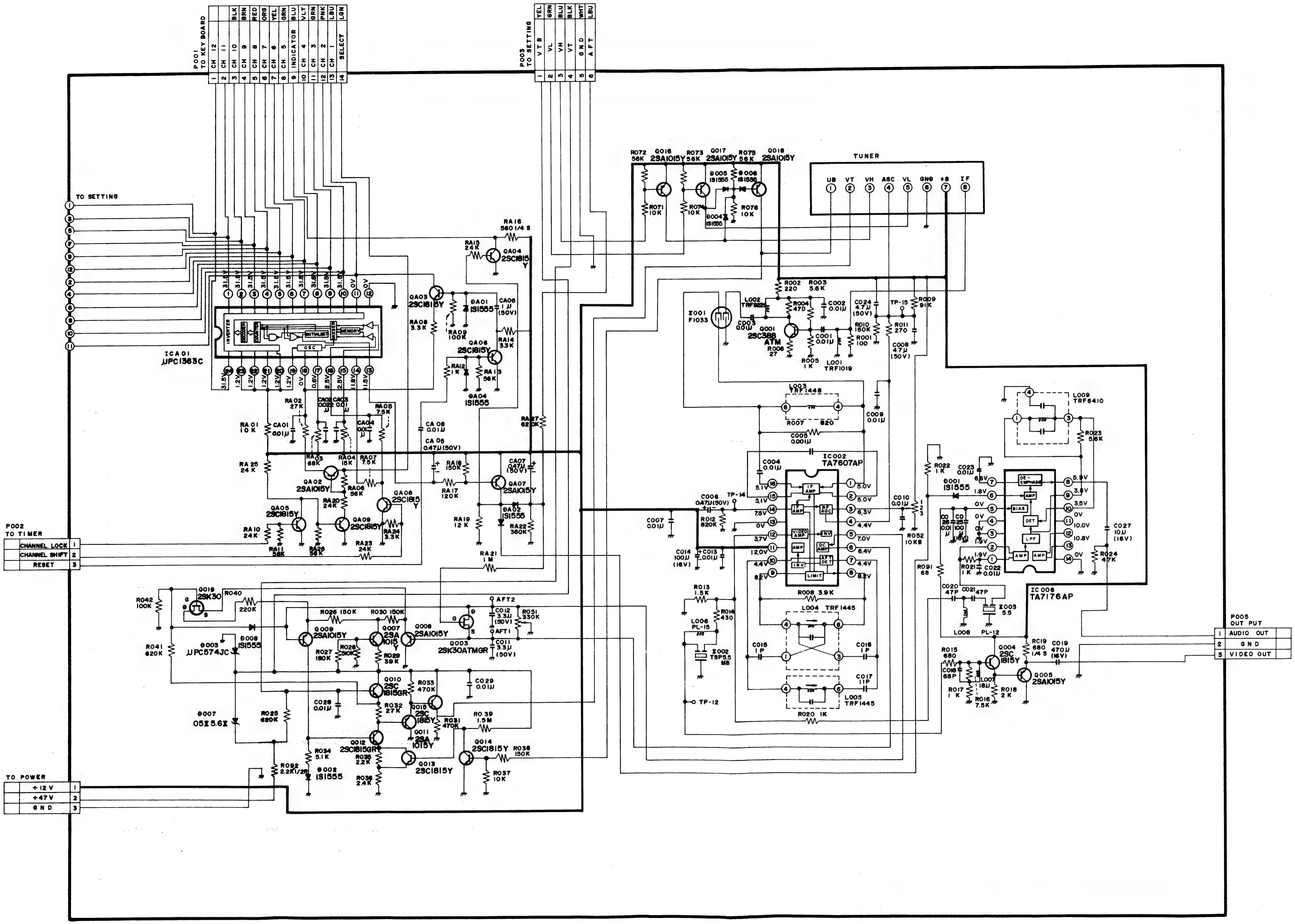
PRE AMP CIRCUIT 70191547

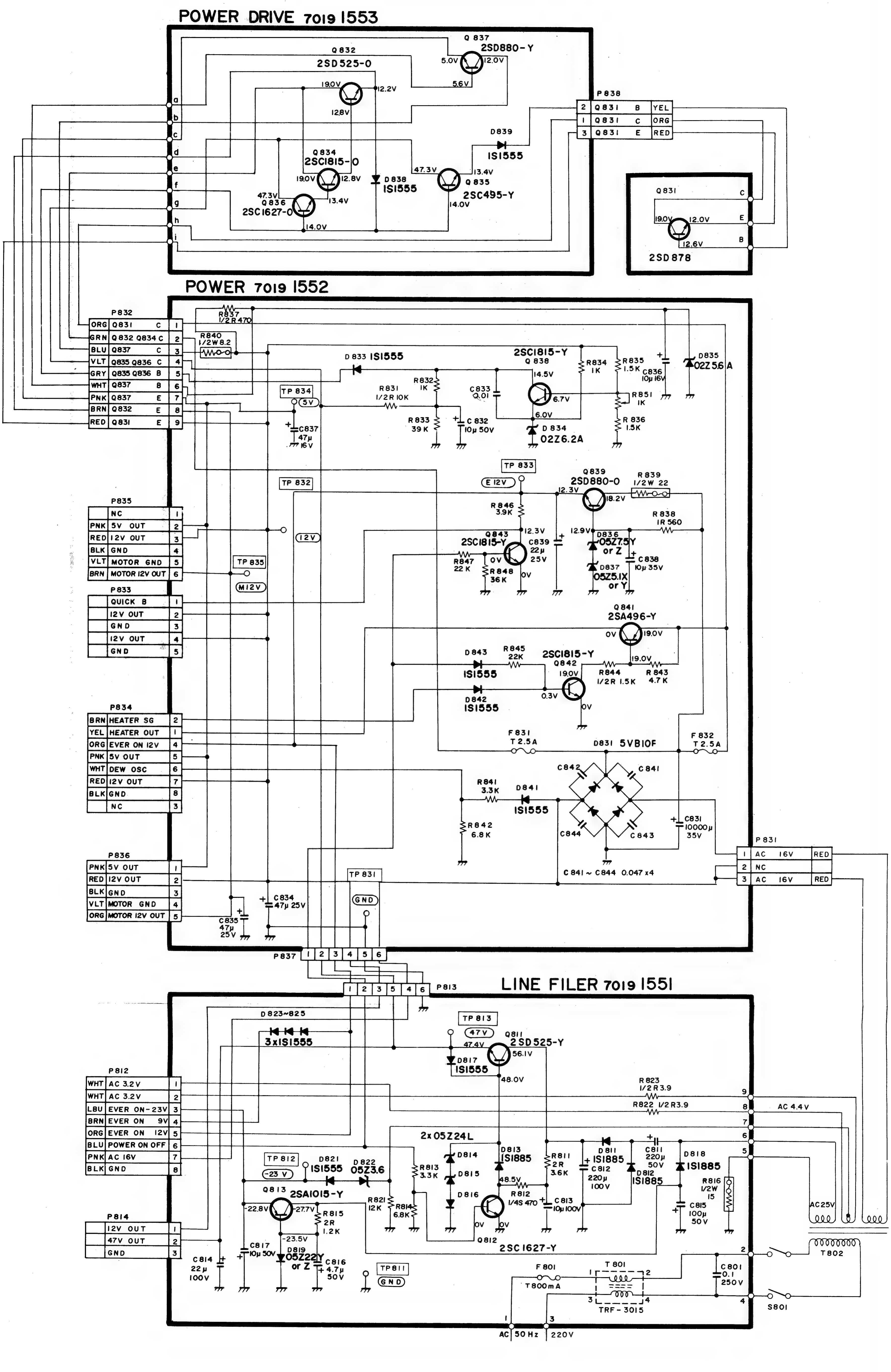


5. SERVO II CIRCUIT

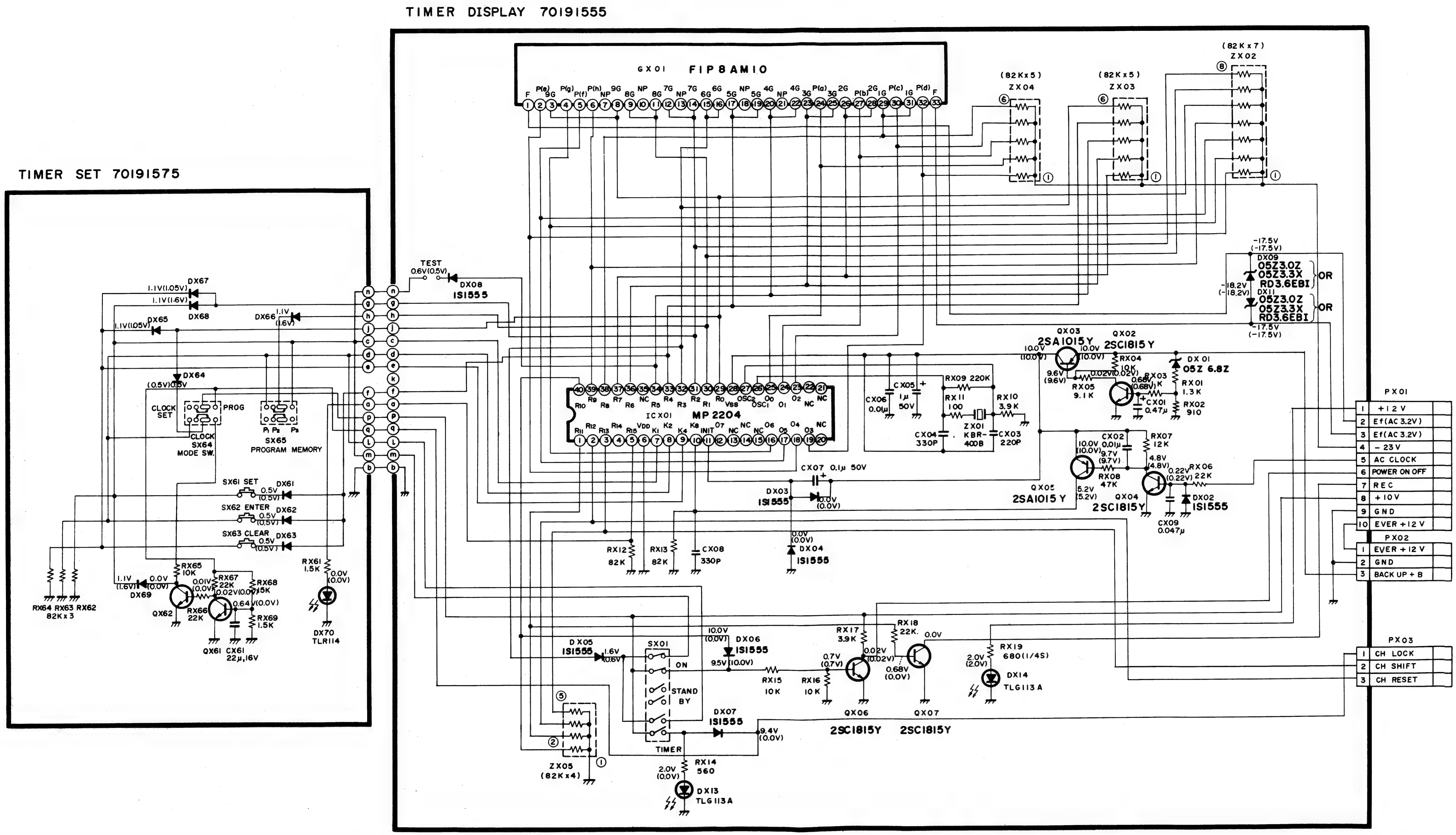


6. SELECTOR CIRCUIT



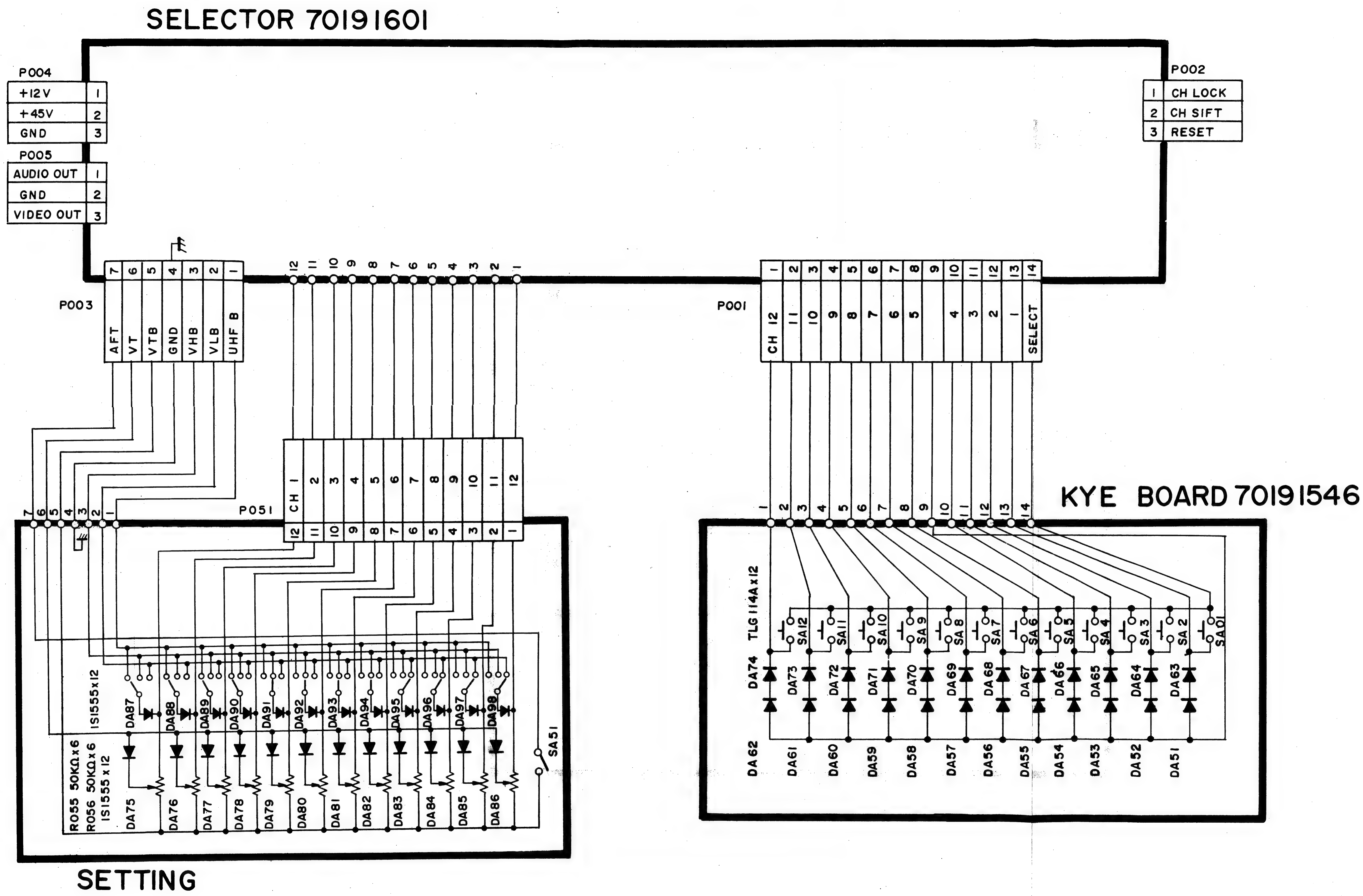

POWER DRIVE 7019 1553
Q 832
2SD525-O
Q 837
2SD880-Y
Q 834
2SC1815-O
Q 836
2SC1627-O
D 838
1S1555
Q 835
2SC495-Y
D839
1S1555
P 838
2 Q831 B YEL
1 Q831 C ORG
3 Q831 E RED
Q831
2SD 878
POWER 7019 1552
P832
ORG Q831 C 1
GRN Q832 Q834 C 2
BLU Q837 C 3
VLT Q835 Q836 C 4
GRY Q835 Q836 B 5
WHT Q837 B 6
PNK Q837 E 7
BRN Q832 E 8
RED Q831 E 9
P835
NC 1
PNK 5V OUT 2
RED 12V OUT 3
BLK GND 4
VLT MOTOR GND 5
BRN MOTOR 12V OUT 6
P833
QUICK B 1
12V OUT 2
GND 3
12V OUT 4
GND 5
P834
BRN HEATER SG 2
YEL HEATER OUT 1
ORG EVER ON 12V 4
PNK 5V OUT 5
WHT DEW OSC 6
RED 12V OUT 7
BLK GND 8
NC 3
P836
PNK 5V OUT 1
RED 12V OUT 2
BLK GND 3
VLT MOTOR GND 4
ORG MOTOR 12V OUT 5
2SC1815-Y
Q 838
D 834
02Z6.2A
D835
02Z5.6A
Q839
2SD880-O
Q843
2SC1815-Y
D836
05Z7.5Y
or Z
D837
05Z5.1X
or Y
Q841
2SA496-Y
2SC1815-Y
Q842
D843
1S1555
D842
1S1555
F831
T 2.5A
D831 5VB10F
F 832
T 2.5A
D841
1S1555
C831
10000μ
35V
C 841 ~ C 844 0.047 x 4
P 831
1 AC 16V RED
2 NC
3 AC 16V RED
P837
P813
LINE FILER 7019 1551
D 823~825
3x1S1555
Q811
2SD525-Y
D817
1S1555
P812
WHT AC 3.2V 1
WHT AC 3.2V 2
LBU EVER ON-23V 3
BRN EVER ON 9V 4
ORG EVER ON 12V 5
BLU POWER ON OFF 6
PNK AC 16V 7
BLK GND 8
2x05Z24L
D821
1S1555
D822
05Z3.6
Q813
2SA1015-Y
D819
05Z22Y
or Z
Q812
2SC1627-Y
D811
1S1885
D812
1S1885
D818
1S1885
D813
1S1885
P814
12V OUT 1
47V OUT 2
GND 3
F 801
T800mA
T 801
TRF-3015
T802
S801
AC 50 Hz 220V

8. TIMER CIRCUIT

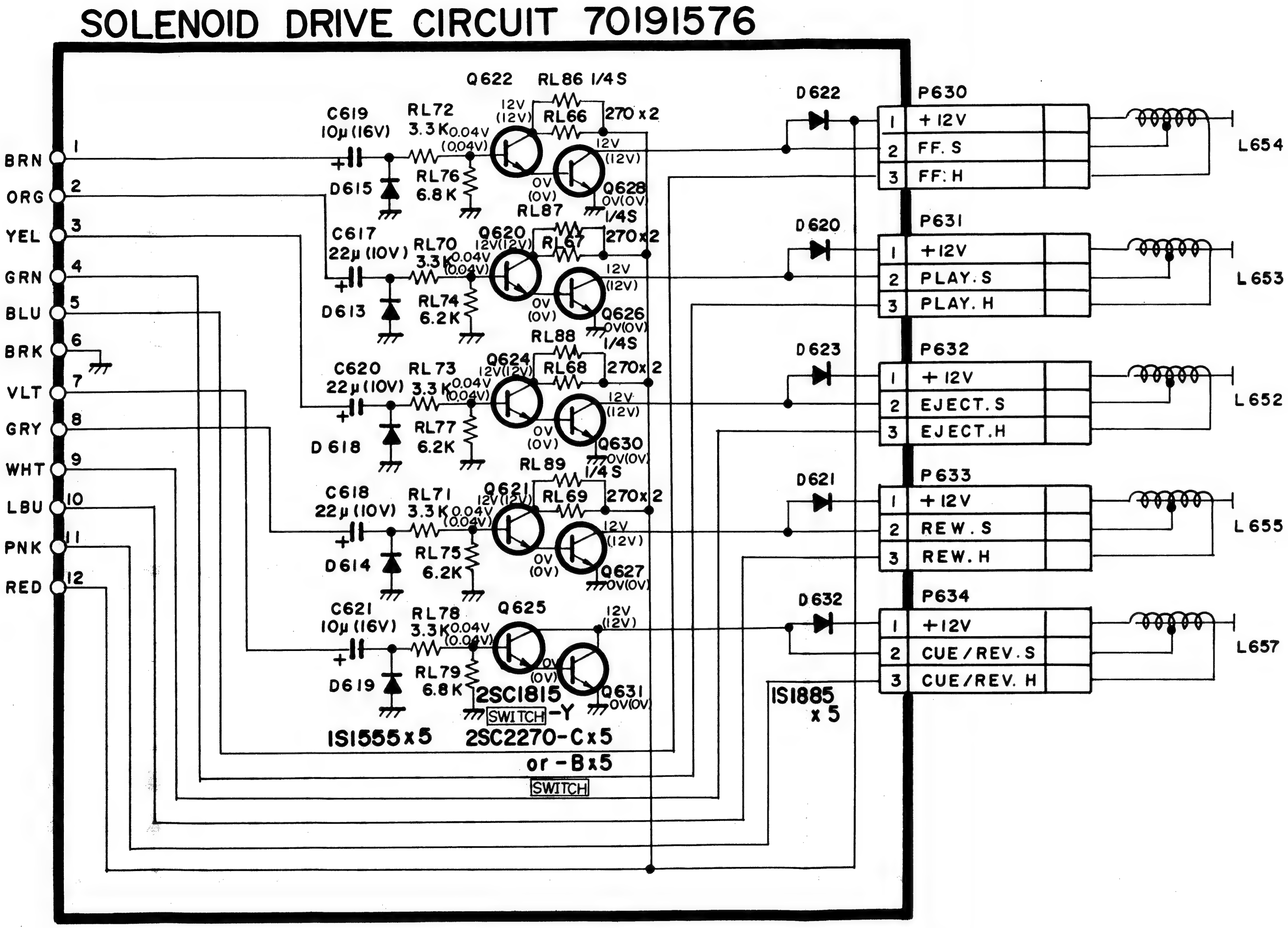


( ) POWER ON/PLAY
—— TIMER REC

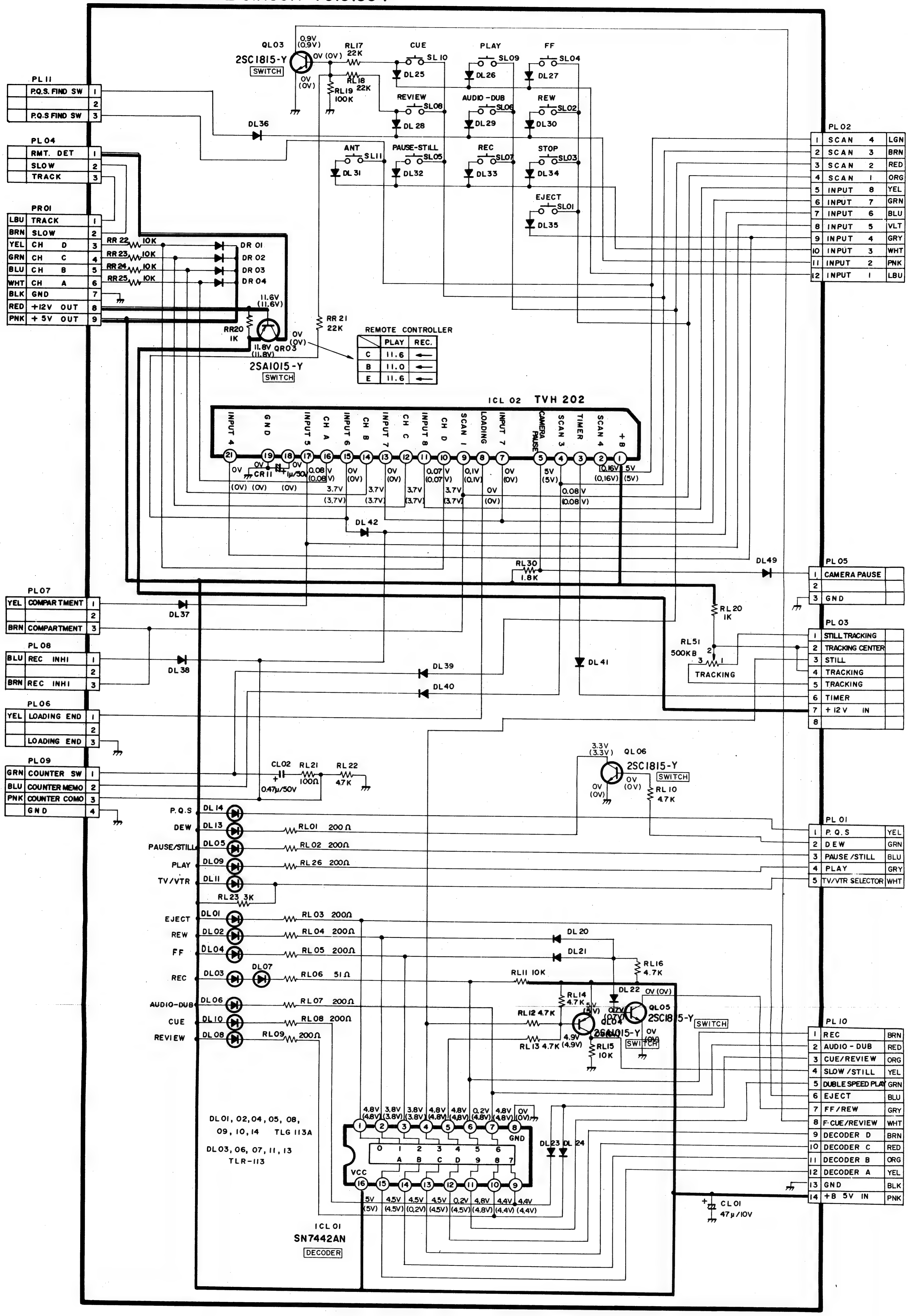
9. SETTING CIRCUIT



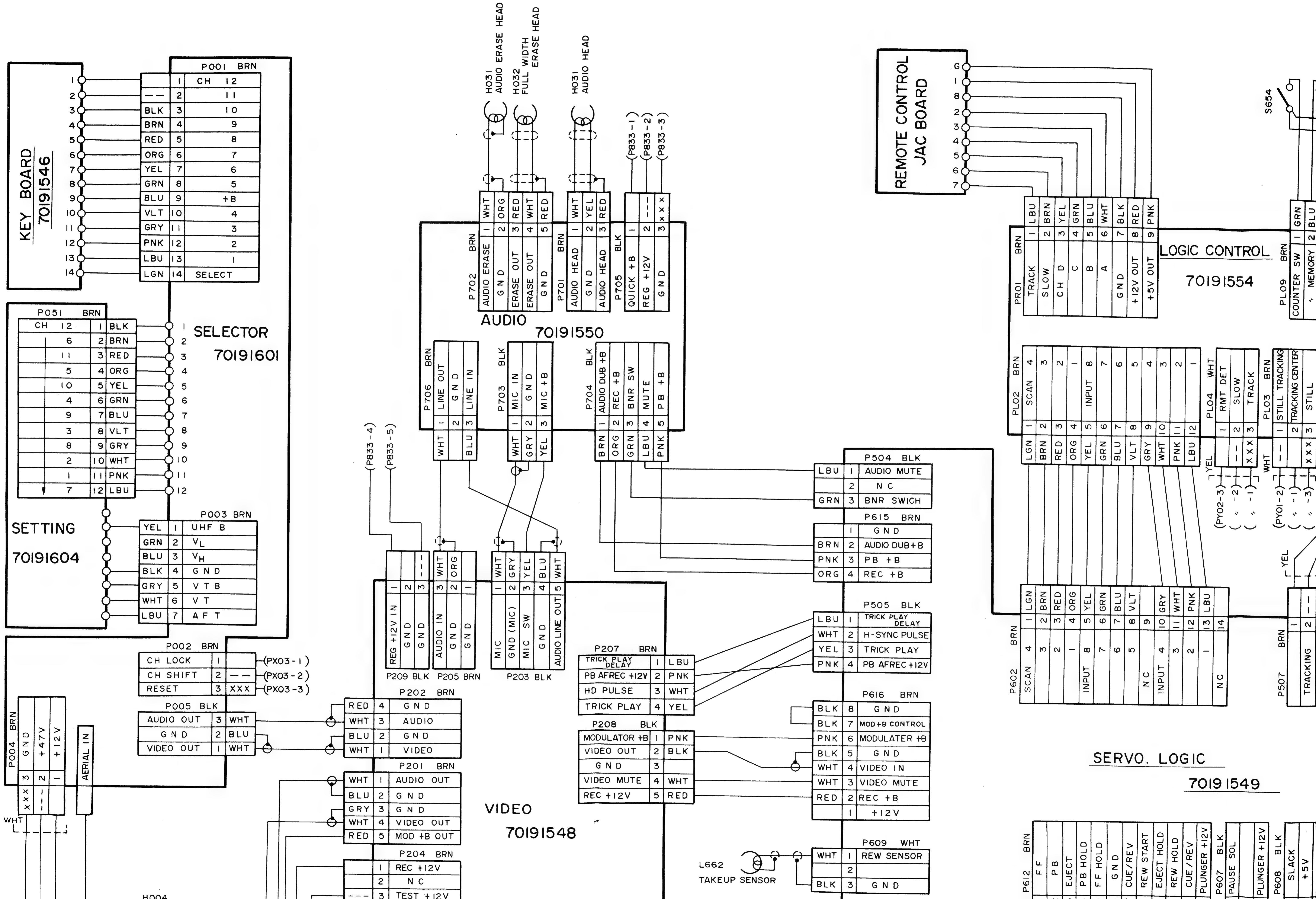
10. SOLENOID DRIVE CIRCUIT

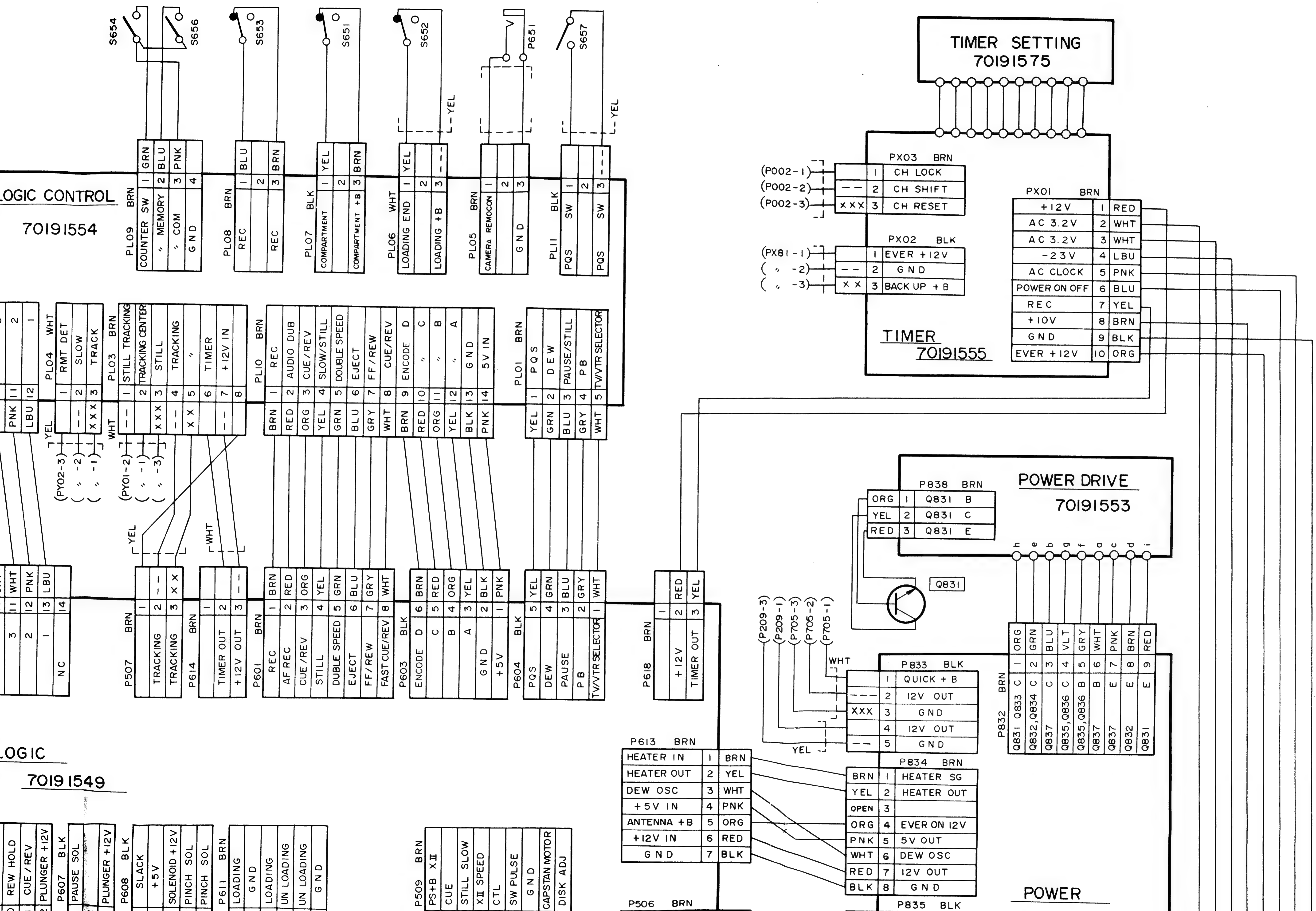


LOGIC CONTROL CIRCUIT 70191554

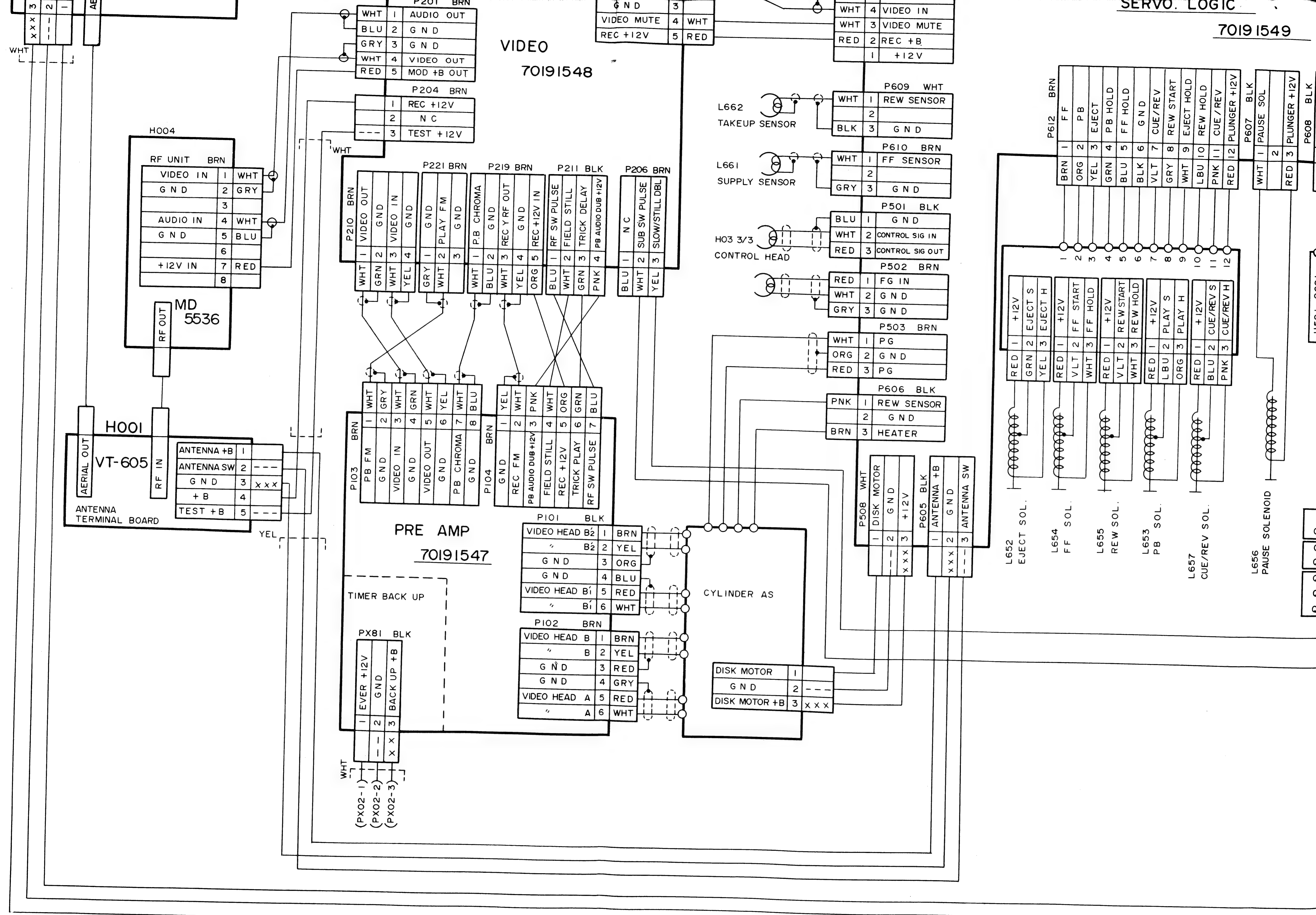


12. OVERALL WIRING DIAGRAM

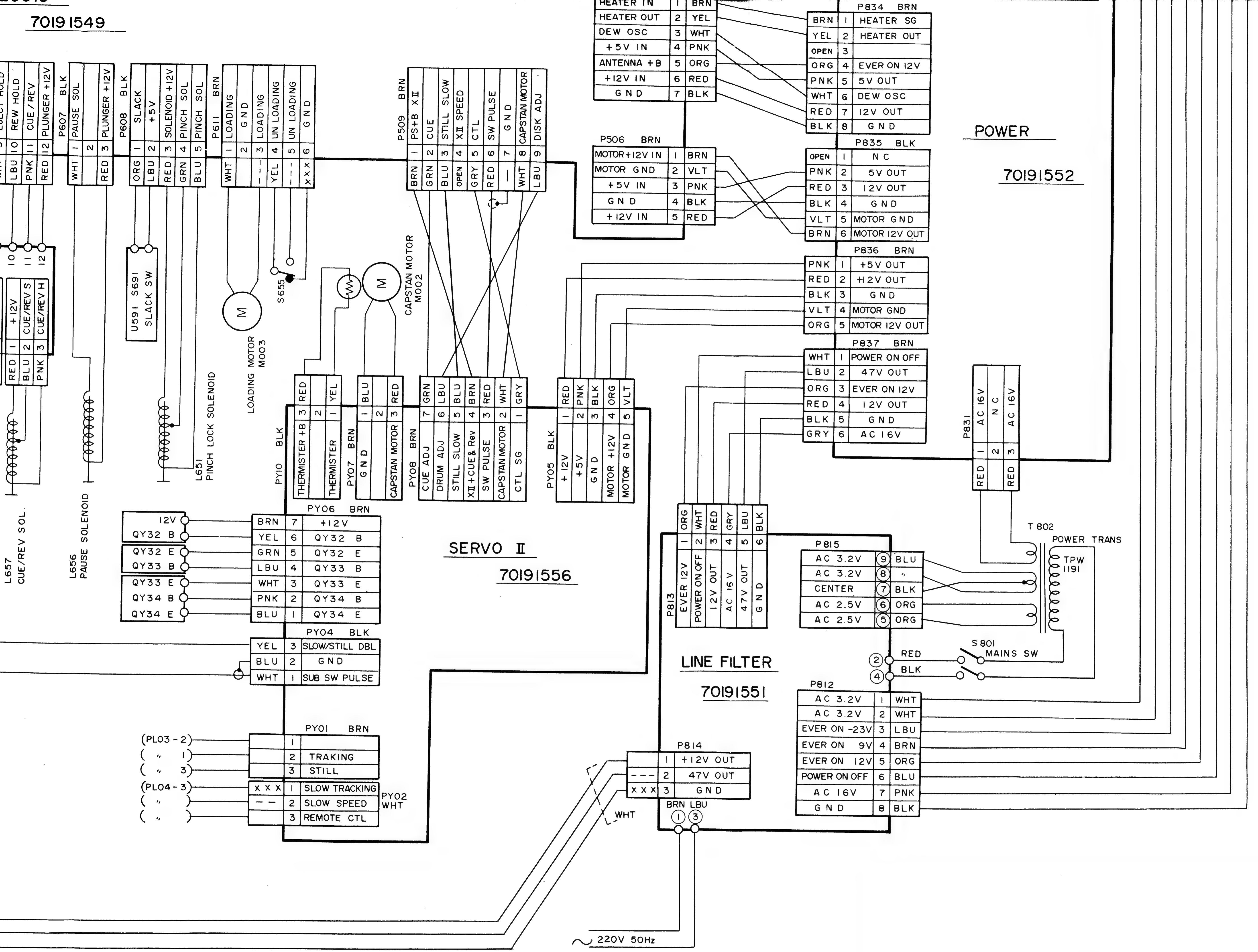




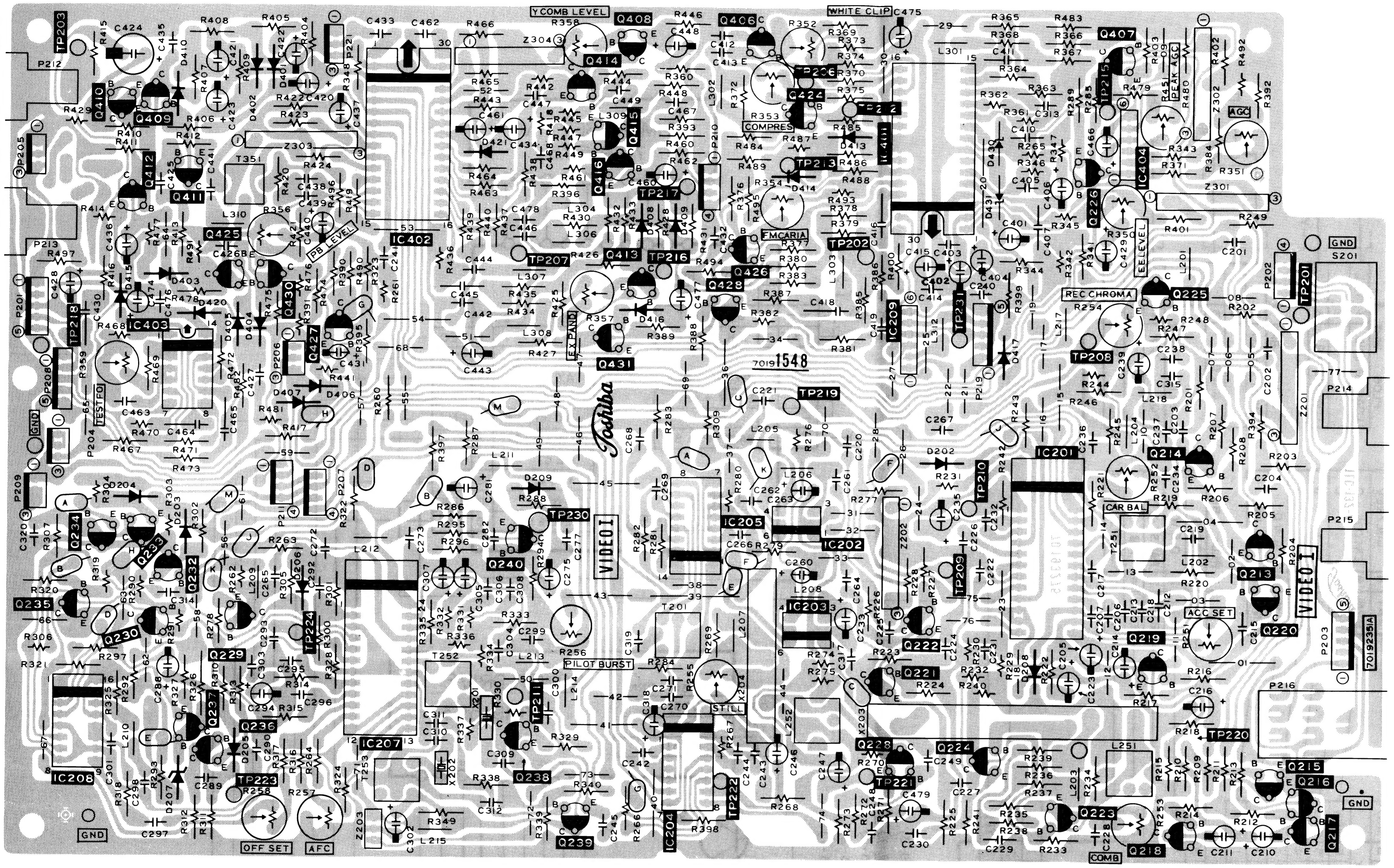
S654
S656
S653
S651
S652
P651
S657
LOGIC CONTROL
70191554
PL09 BRN
COUNTER SW
MEMORY
COM
GND
PL08 BRN
REC
PL07 BLK
COMPARTMENT
COMPARTMENT +B
PL06 WHT
LOADING END
LOADING +B
PL05 BRN
CAMERA REMOCON
GND
PL11 BLK
PQS SW
PL04 WHT
RMT DET
SLOW
TRACK
PL03 BRN
STILL TRACKING
TRACKING CENTER
STILL
TRACKING
TIMER
+12V IN
PL10 BRN
REC
AUDIO DUB
CUE/REV
SLOW/STILL
DOUBLE SPEED
EJECT
FF/REW
CUE/REV
ENCODE D
C
B
A
GND
5V IN
PL01 BRN
PQS
DEW
PAUSE/STILL
PB
TV/VTR SELECTOR
(PY02-3)
(PY01-2)
P507 BRN
TRACKING
P614 BRN
TIMER OUT
+12V OUT
P601 BRN
REC
AF REC
CUE/REV
STILL
DUBLE SPEED
EJECT
FF/REW
FAST CUE/REV
P603 BLK
ENCODE D
C
B
A
GND
+5V
P604 BLK
PQS
DEW
PAUSE
PB
TV/VTR SELECTOR
P618 BRN
+12V
TIMER OUT
NC
LOGIC
70191549
REW HOLD
CUE/REV
PLUNGER +12V
P607 BLK
PAUSE SOL
PLUNGER +12V
P608 BLK
SLACK
+5V
SOLENOID +12V
PINCH SOL
PINCH SOL
P611 BRN
LOADING
GND
LOADING
UN LOADING
UN LOADING
GND
P509 BRN
PS+B XII
CUE
STILL SLOW
XII SPEED
CTL
SW PULSE
GND
CAPSTAN MOTOR
DISK ADJ
TIMER SETTING
70191575
PX03 BRN
CH LOCK
CH SHIFT
CH RESET
(P002-1)
(P002-2)
(P002-3)
PX02 BLK
EVER +12V
GND
BACK UP +B
(PX81-1)
PX01 BRN
+12V
AC 3.2V
AC 3.2V
-23V
AC CLOCK
POWER ON OFF
REC
+10V
GND
EVER +12V
TIMER
70191555
POWER DRIVE
70191553
P838 BRN
Q831 B
Q831 C
Q831 E
Q831
P832 BRN
Q831 Q833 C
Q832,Q834 C
Q837 C
Q835,Q836 C
Q835,Q836 B
Q837 B
Q837 E
Q832 E
Q831 E
(P209-3)
(P209-1)
(P705-3)
(P705-2)
(P705-1)
P833 BLK
QUICK +B
12V OUT
GND
12V OUT
GND
P613 BRN
HEATER IN
HEATER OUT
DEW OSC
+5V IN
ANTENNA +B
+12V IN
GND
P834 BRN
HEATER SG
HEATER OUT
OPEN
EVER ON 12V
5V OUT
DEW OSC
12V OUT
GND
P506 BRN
P835 BLK
POWER

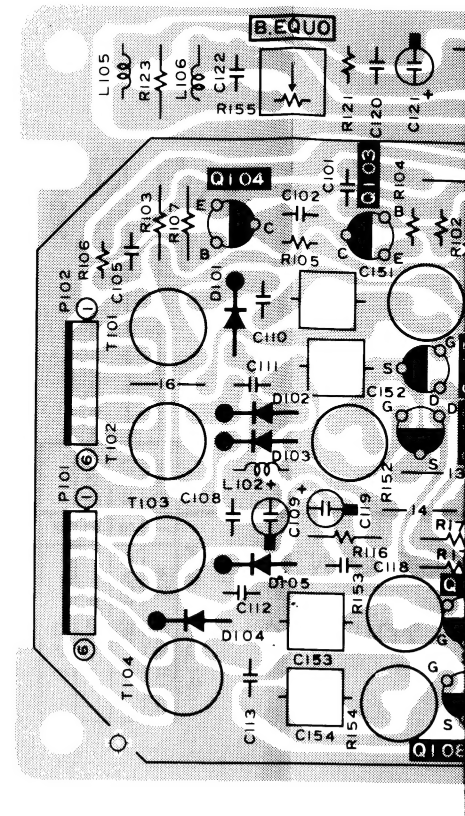


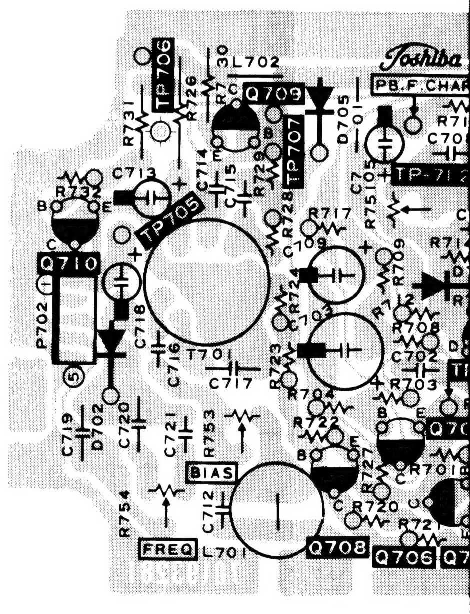
SERVO. LOGIC
70191549
VIDEO
70191548
P201 BRN
WHT 1 AUDIO OUT
BLU 2 GND
GRY 3 GND
WHT 4 VIDEO OUT
RED 5 MOD +B OUT
P204 BRN
1 REC +12V
2 NC
3 TEST +12V
GND 3
VIDEO MUTE 4 WHT
REC +12V 5 RED
WHT 4 VIDEO IN
WHT 3 VIDEO MUTE
RED 2 REC +B
1 +12V
H004
RF UNIT BRN
VIDEO IN 1 WHT
GND 2 GRY
3
AUDIO IN 4 WHT
GND 5 BLU
6
+12V IN 7 RED
8
MD 5536
RF OUT
P210 BRN
VIDEO OUT
GND
VIDEO IN
GND
P221 BRN
GND
PLAY FM
GND
P219 BRN
P.B CHROMA
GND
REC Y RF OUT
GND
REC +12V IN
P211 BLK
RF SW PULSE
FIELD STILL
TRICK DELAY
PB AUDIO DUB +12V
P206 BRN
NC
SUB SW PULSE
SLOW/STILL DBL
L662
TAKEUP SENSOR
L661
SUPPLY SENSOR
H03 3/3
CONTROL HEAD
P609 WHT
WHT 1 REW SENSOR
2
BLK 3 GND
P610 BRN
WHT 1 FF SENSOR
2
GRY 3 GND
P501 BLK
BLU 1 GND
WHT 2 CONTROL SIG IN
RED 3 CONTROL SIG OUT
P502 BRN
RED 1 FG IN
WHT 2 GND
GRY 3 GND
P503 BRN
WHT 1 PG
ORG 2 GND
RED 3 PG
P606 BLK
PNK 1 REW SENSOR
2 GND
BRN 3 HEATER
P612 BRN
FF
PB
EJECT
PB HOLD
FF HOLD
GND
CUE/REV
REW START
EJECT HOLD
REW HOLD
CUE/REV
PLUNGER +12V
P607 BLK
PAUSE SOL
P608 BLK
PLUNGER +12V
+12V EJECT S EJECT H
+12V FF START FF HOLD
+12V REW START REW HOLD
+12V PLAY S PLAY H
+12V CUE/REV S CUE/REV H
L652 EJECT SOL.
L654 FF SOL.
L655 REW SOL.
L653 PB SOL.
L657 CUE/REV SOL.
L656 PAUSE SOLENOID
H001
VT-605
AERIAL OUT
RF IN
ANTENNA +B 1
ANTENNA SW 2
GND 3
+B 4
TEST +B 5
ANTENNA TERMINAL BOARD
PREAMP
70191547
P103 BRN
PB FM
GND
VIDEO IN
GND
VIDEO OUT
GND
PB CHROMA
GND
P104 BRN
GND
REC FM
PB AUDIO DUB +12V
FIELD STILL
REC +12V
TRICK PLAY
RF SW PULSE
TIMER BACK UP
PX81 BLK
EVER +12V
GND
BACK UP +B
(PX02-1)
(PX02-2)
(PX02-3)
P101 BLK
VIDEO HEAD B'2 1 BRN
" B'2 2 YEL
GND 3 ORG
GND 4 BLU
VIDEO HEAD B'1 5 RED
" B'1 6 WHT
P102 BRN
VIDEO HEAD B 1 BRN
" B 2 YEL
GND 3 RED
GND 4 GRY
VIDEO HEAD A 5 RED
" A 6 WHT
CYLINDER AS
DISK MOTOR 1
GND 2
DISK MOTOR +B 3
P508 WHT
DISK MOTOR
GND
+12V
P605 BLK
ANTENNA +B
GND
ANTENNA SW


70191549
P607 BLK
PAUSE SOL
PLUNGER +12V
P608 BLK
SLACK
+5V
SOLENOID +12V
PINCH SOL
P611 BRN
LOADING
GND
UN LOADING
P509 BRN
PS+B XII
CUE
STILL SLOW
XII SPEED
CTL
SW PULSE
CAPSTAN MOTOR
DISK ADJ
HEATER IN
HEATER OUT
DEW OSC
+5V IN
ANTENNA +B
+12V IN
P834 BRN
HEATER SG
EVER ON 12V
5V OUT
12V OUT
P506 BRN
MOTOR+12V IN
MOTOR GND
P835 BLK
NC
MOTOR 12V OUT
POWER
70191552
P836 BRN
P837 BRN
POWER ON OFF
47V OUT
AC 16V
P831
U591 S691
SLACK SW
LOADING MOTOR
M003
S655
CAPSTAN MOTOR
M002
L657
CUE/REV SOL.
L656
PAUSE SOLENOID
L651
PINCH LOCK SOLENOID
PY10 BLK
THERMISTER +B
THERMISTER
PY07 BRN
PY08 BRN
CUE ADJ
DRUM ADJ
XII +CUE & Rev
CTL SG
PY05 BLK
MOTOR +12V
PY06 BRN
QY32 B
QY32 E
QY33 B
QY33 E
QY34 B
QY34 E
SERVO II
70191556
PY04 BLK
SLOW/STILL DBL
SUB SW PULSE
PY01 BRN
TRAKING
STILL
SLOW TRACKING
SLOW SPEED
REMOTE CTL
PY02 WHT
(PL03-2)
(PL04-3)
P813
EVER ON 12V
P815
AC 3.2V
CENTER
AC 2.5V
T 802
POWER TRANS
TPW 1191
S801
MAINS SW
LINE FILTER
70191551
P812
EVER ON -23V
EVER ON 9V
EVER ON 12V
P814
+12V OUT
WHT
220V 50Hz

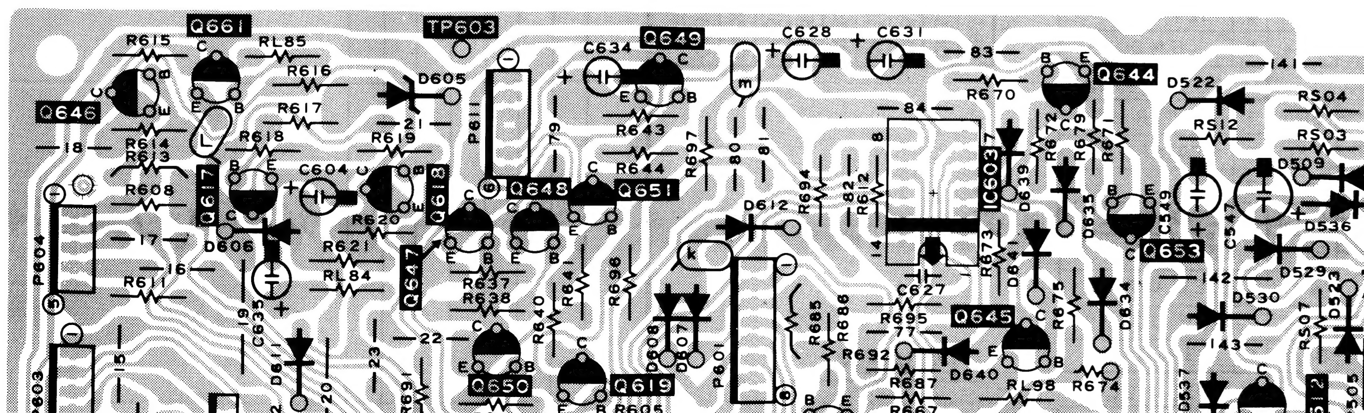
VIDEO BOARD

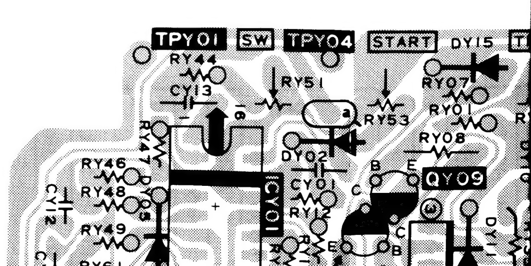




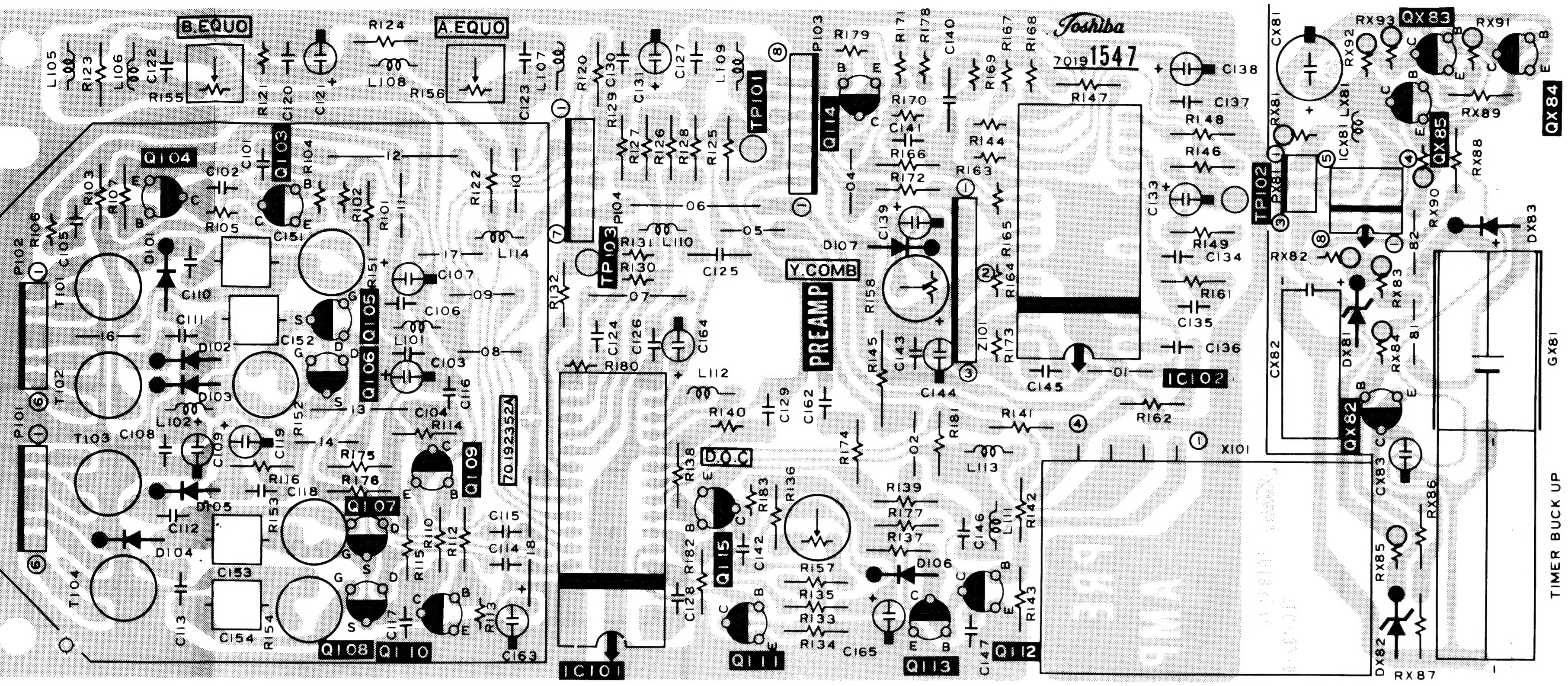


SERVO BOARD

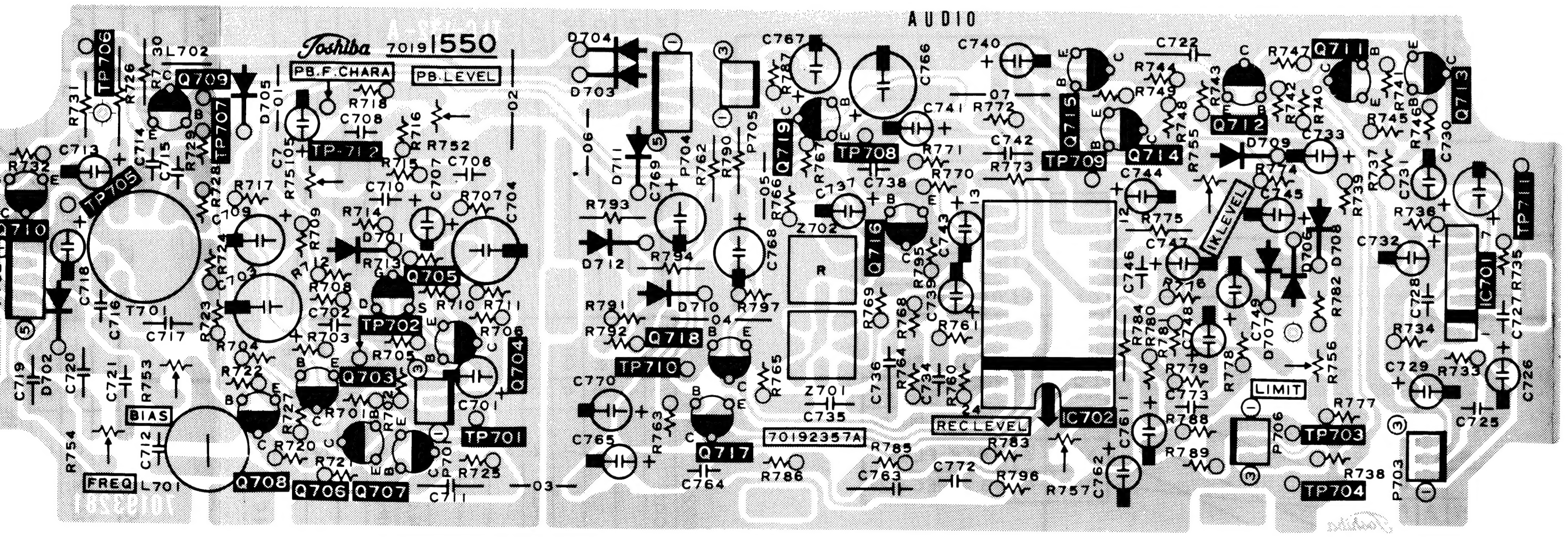




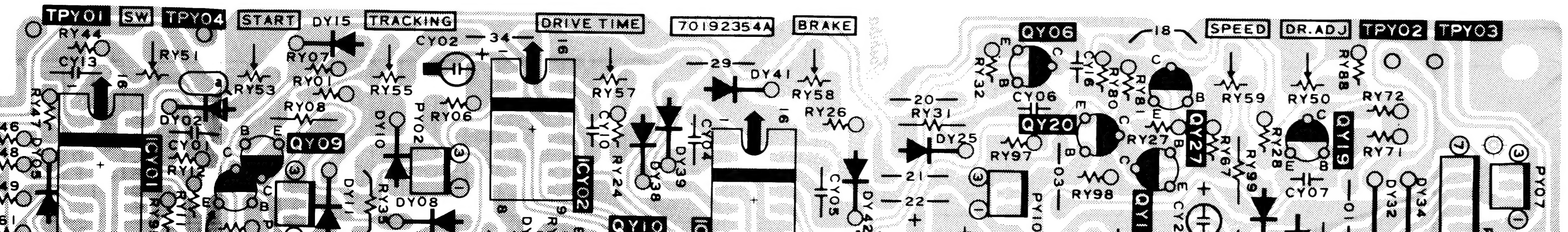
PRE AMP BOARD



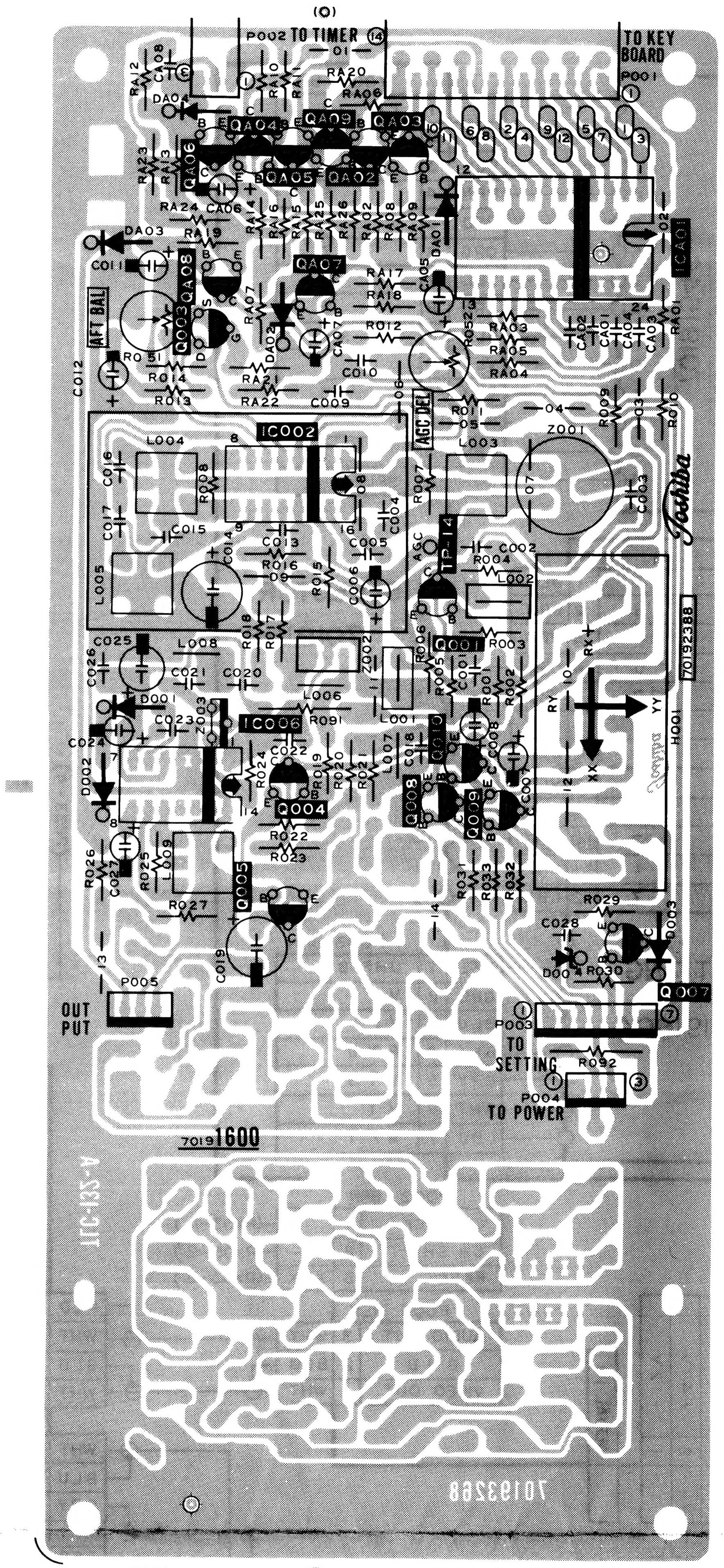
AUDIO BOARD



SERVO II BOARD



SELECTOR BOARD



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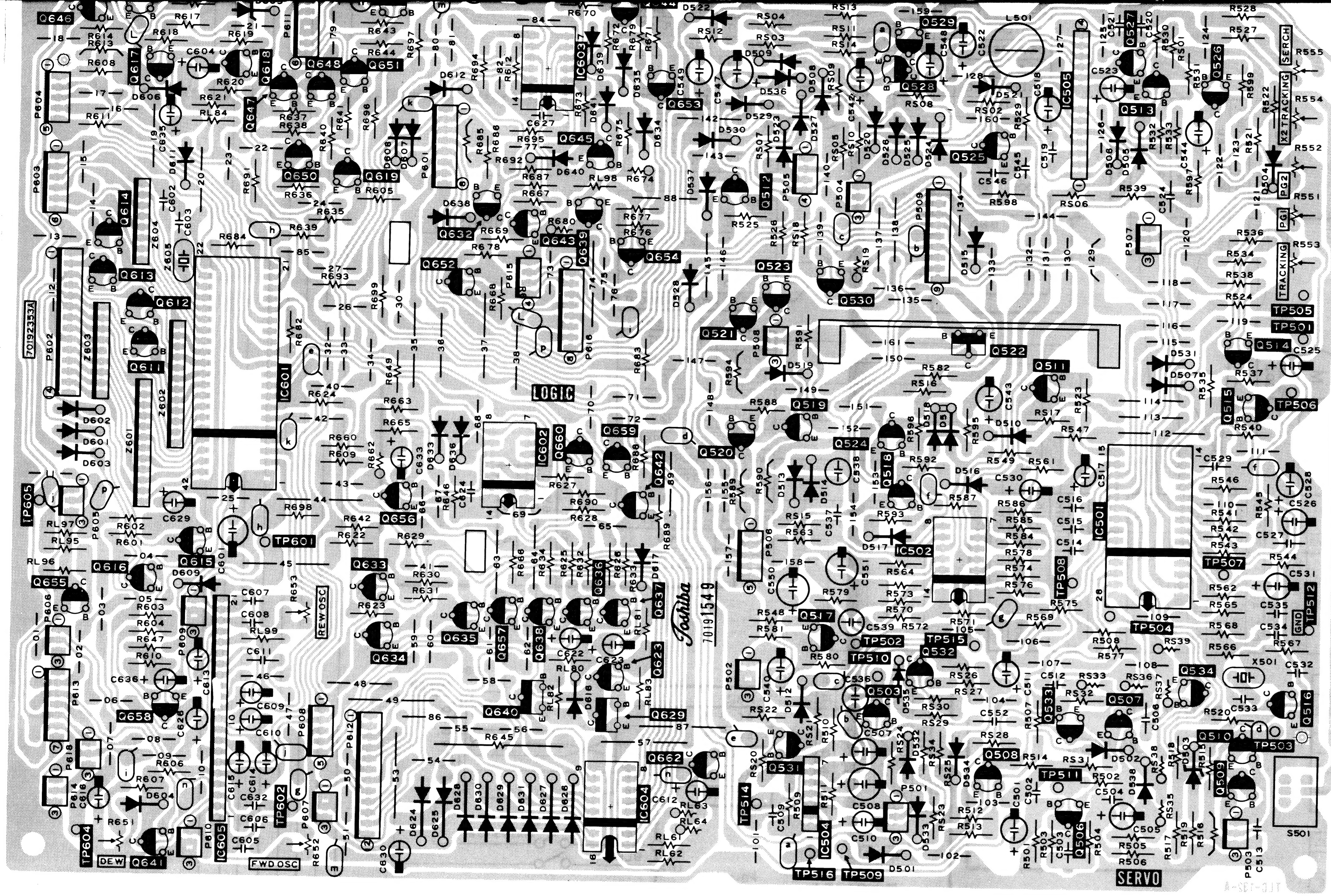
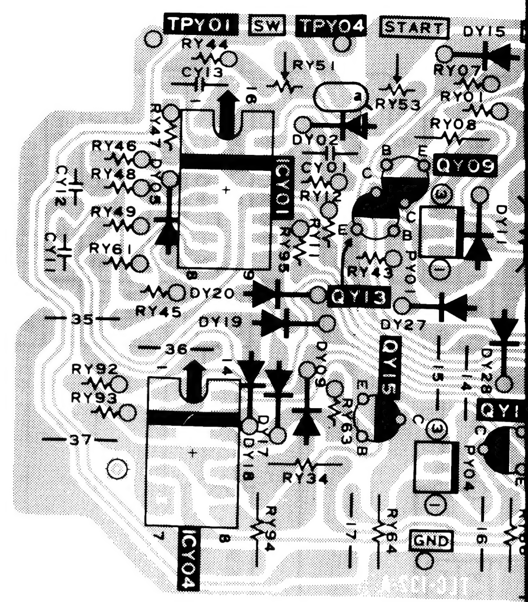
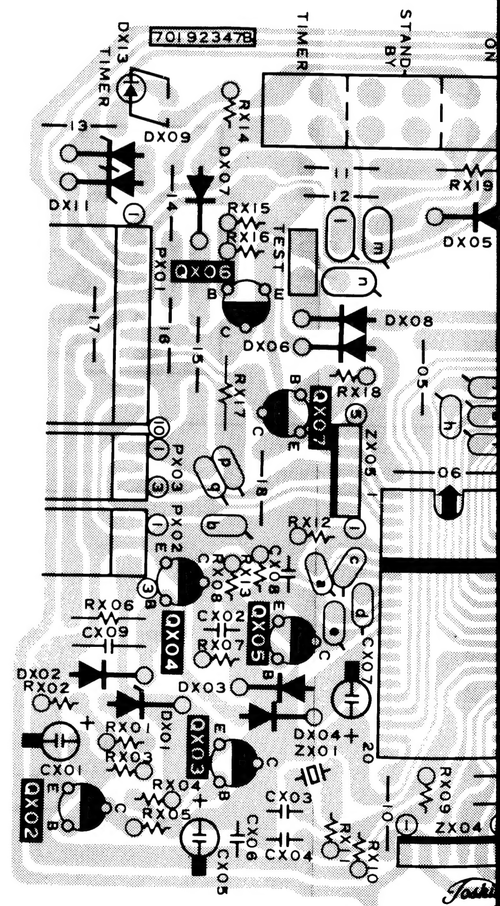
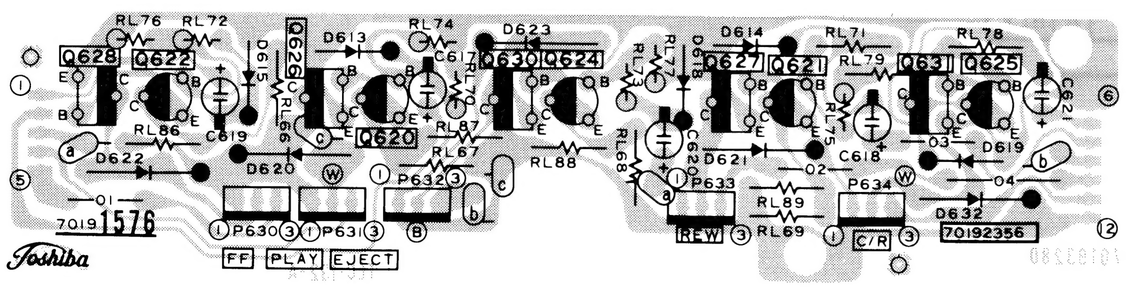




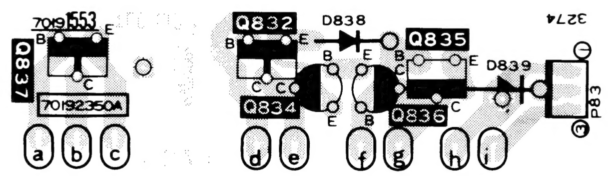


TIMER
DISPLAY

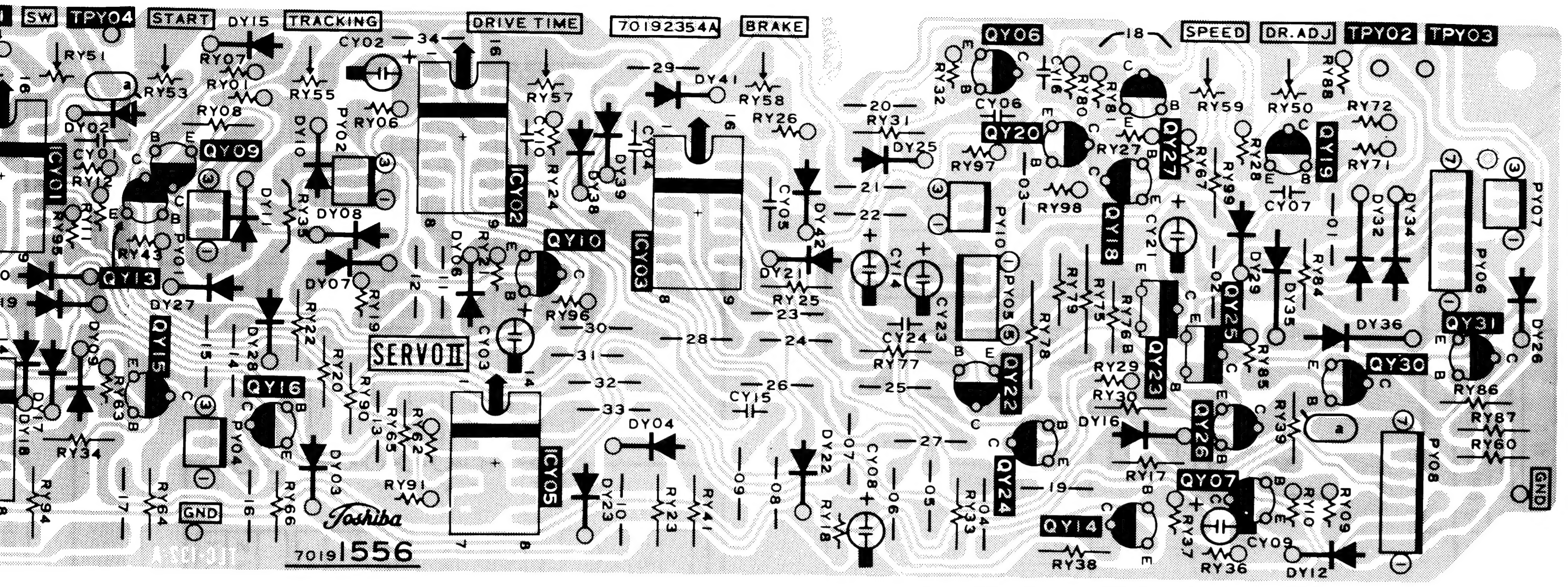
SOLENOID BOARD

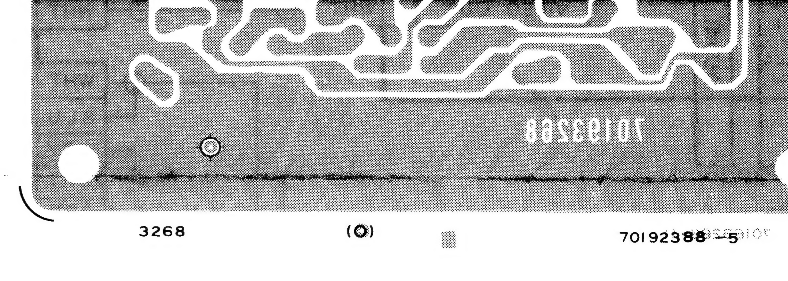


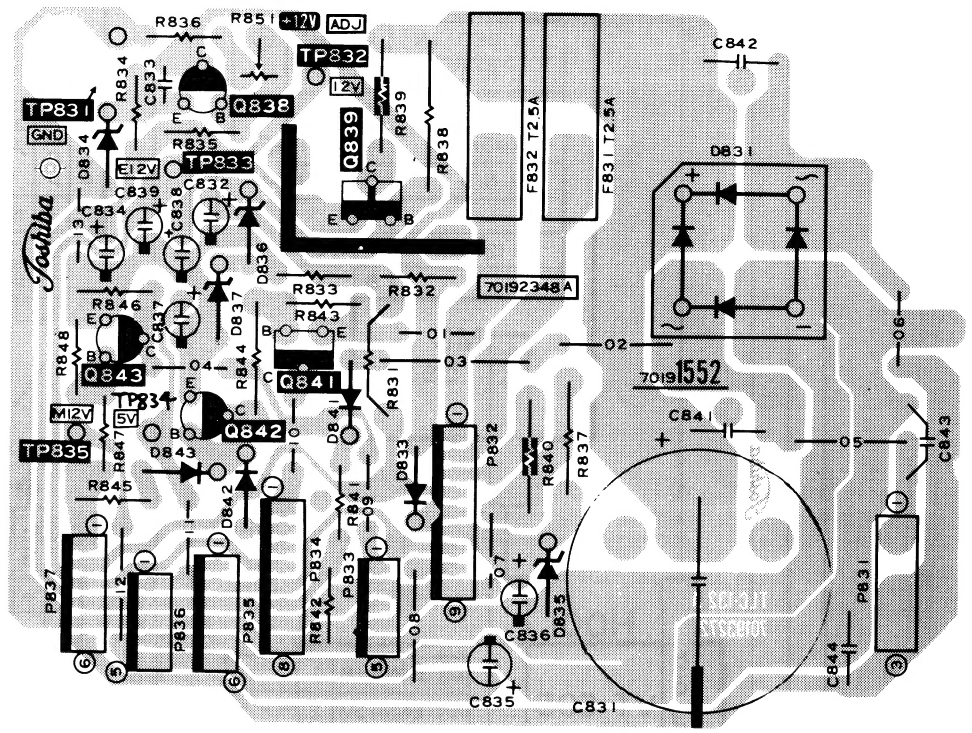
POWER DRIVE BOARD



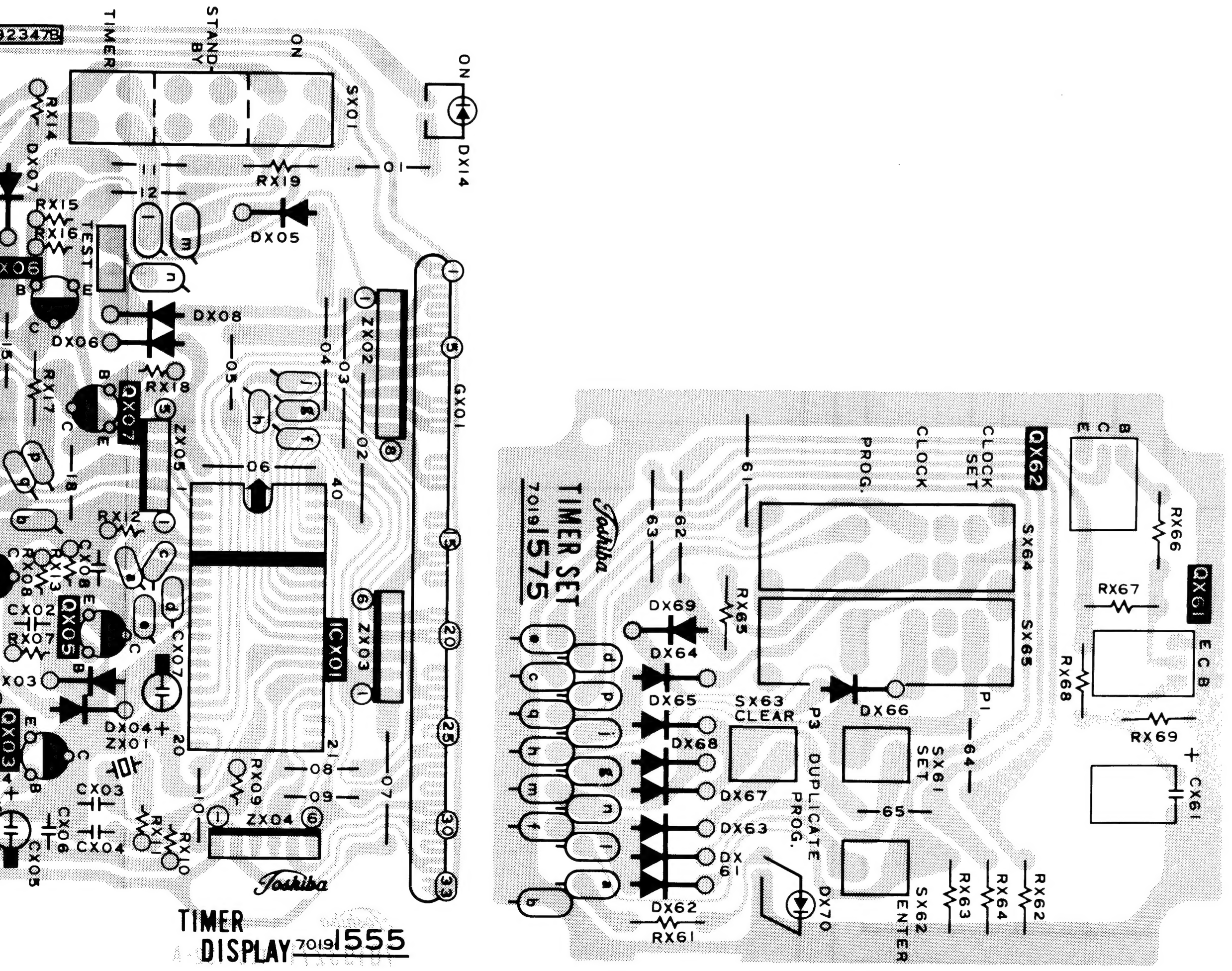
SERVO II BOARD







TIMER BOARD



LOGIC CONTROL BOARD